

```

*****
*
*          MM 6309 ROM CODING
*          DEVICE DECODER
*          RPU/MAG TAPE INTERFACE
*
*****

```

```

*
* OUTPUT      NAME      CODE      ROM ADDRESS
*   Q7      GRPSEL     ALL      ALL VALID
*   Q6      PTPSEL     13       64
*   Q5      PTRSEL     12       65
*   Q4      LPT1SL     57       20
*   Q3      TT01SL     51       26
*   Q2      TT11SL     50       27
*   Q1      LPTSEL     17       60
*   Q0      MTSEL      22       55
*
*

```

```

*
*          HEX      DEV ROM
*          NAME     DATA  CODE CODING

```

```

0010          ORG      $10
0010      6F      LPTSEL FCB $6F      57 01101111
0016          ORG      $16
0016      77      TT01SL FCB $77      51 01110111
0017      7B      TT11SL FCB $7B      50 01111011
002D          ORG      $2D
002D      7E      MTSEL  FCB $7E      22 01111110
0034          ORG      $34
0034      3F      PTPSEL FCB $3F      13 00111111
0035      5F      PTRSEL FCB $5F      12 01011111
          END

```

NUMBER OF SOURCE LINES = 33

TOTAL ERRORS = 0 TOTAL WARNINGS = 0

2D 7E
 34 3F
 CS = FDBF

FDBF
 81
 C0
 FFB0

```

*****
*
*      MM 6308 ROM CODING
*      DEVICE ENCODER
*      RPU/MAG TAPE INTERFACE
*
*****

```

			HEX	DEV ROM
			DATA	CODE DATA
0001		ORG	\$01	
0001	ED	MTSEL	\$ED	22 XX101101
0002	E8	LPTSEL	\$E8	17 XX101000
0004		ORG	\$04	
0004	D7	TT11	\$D7	50 XX010111
0008		ORG	\$08	
0008	D6	TT01	\$D6	51 XX010110
0010		ORG	\$10	
0010	D0	LP2	\$D0	57 XX010000
0020		ORG	\$20	
0020	F5	PTR	\$F5	12 XX110101
0040		ORG	\$40	
0040	F4	PTP	\$F4	13 XX110100
		END		

NUMBER OF SOURCE LINES = 25
TOTAL ERRORS = 0 TOTAL WARNINGS = 0

41 ED

Should be

1	ED	(22 ₈)	MT
40	F4	(13 ₈)	RPU
41	ED		

CS=FIED

DETAIL OF GB21 REGISTERS

REGISTER DEFINITION - RPU CONTROLLER

ECL CONTROL & RPU CONTROL

Register Overview

- REG 0 → ECL CONTROL OR DMA DIRECTION DEPENDENT ON SET P.
- REG 1 → Control Register For REG 0
- REG 2 → RPU CONTROL OR DATA DIRECTION
- REG 3 → Control Register For REG 2

Connections For CA1, CA2, CB1, CB2

- CA1 ← COMMAND OR start (From ECLIPSE)
- CA2 ← DMA COMPLETE (From ECLIPSE)
- CB1 ← RPU Field (From RPU - Field Interrupt)
- CB2 ← SCAN LINE (From RPU - END SCAN LINE Interrupt)

DEFINITIONS OF bit names From page 1

NAME	(Full name)	(Function)
CMD	COMMAND	SIGNALS A COMMAND (DAS) HAS COME FROM ECLIPSE
start	start	" " start (DAS) HAS COME FROM ECLIPSE
END	DMA COMPLETE	" " DMA completion from ECLIPSE
Estat.	ECLIPSE DMA status	" " DMA IN PROGRESS (ECL)
W	DIRECTION	0 INDICATES INPT FROM ECLIPSE 1 INDICATES TO ECLIPSE
VP	VIDEO present	" " VIDEO present ON LAST SCAN LINE
RD	RPU DMA status	" " DMA IN PROGRESS (RPU)
MODE	RPU output mode	0 INDICATES IN block mode 1 INDICATES single parameter mode
control	control parameter	Set to indicate control parameter out
Frame/sect.	Frame or section	As 0 INDICATES A Frame (or control) parameter 1 INDICATES section parameter

REGISTER DEFINITIONS - RPU CONTROLLER

BITS. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 * R/W. DESCRIPTION.

ELLIPSE RELATED REGISTERS

ELL DMA ADDR	16 bits		R/W.	ELLIPSE DATA DMA MEMORY ADDRESS REGISTER AND INCR
ELL DATA OUT	16 bits		W	DATA OUT TO ELLIPSE. - sets done - clears DMA.
ELL DMA IN.	16 bits	- all memory	R	DIRECT MEMORY ACCESS FROM ELLIPSE INTO RAM
ELL CONTROL (R/W.)	16 bits	CMD. STRT. END. ESTBL. R R R R	D W	See note next page 1/2 6821
ELL DMA STRT.			W	Any write to this register starts DMA. YR

RPU RELATED REGISTERS

RPU DMA ADDR	16 bits		R/W.	RPU DATA DMA MEMORY ADDRESS REGISTER AND INCR
RPU DMA IN.	16 bits		R	RPU READ DATA - used only as diagnostic reg
RPU DATA OUT	16 bits	- all memory	W	RPU WRITE DATA - used to output parameter blocks
RPU DMA OUT	16 bits	- all memory	W	DIRECT MEMORY ACCESS output for parameter blocks
RPU BLOCK SIZE	8 bits		W	FRAME, section or control block length
PAR ADDR	8 bits		W	SINGLE parameter output parameter address - appended to frame/section/control bits
RPU CONTROL	16 bits	VP RD R R	rw rw rw	See note next page 1/2 6821
RPU command			W	Any write to this register starts DMA YR.

ALIA (6531) registers (see 655) data sheet)

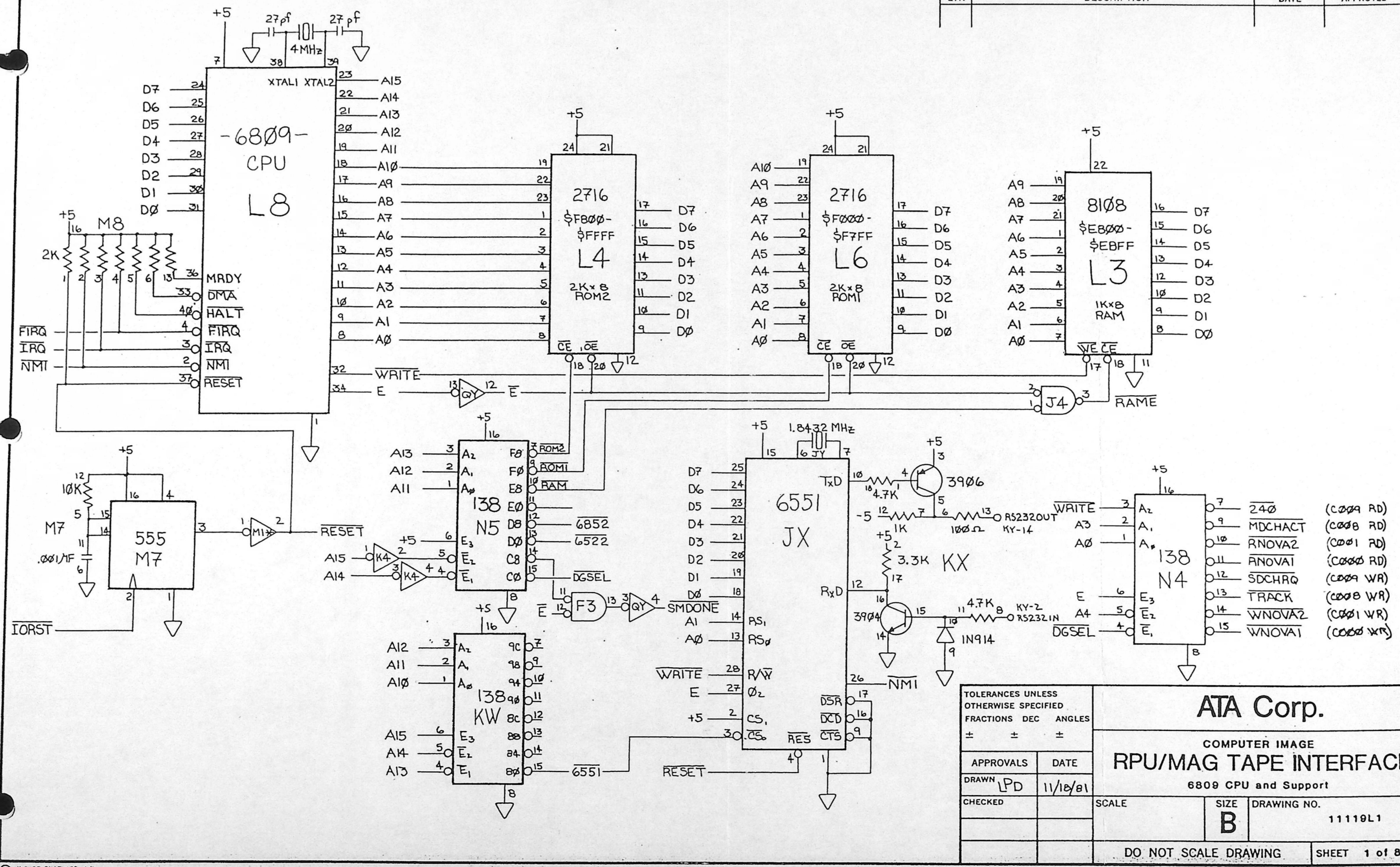
see 1

* NOTE. 16 bit REGISTERS ARE DEFINED AT 2 8 bit REGISTERS FOR 6809 ORDERED MSD - LSB

RPU Interface Schematics

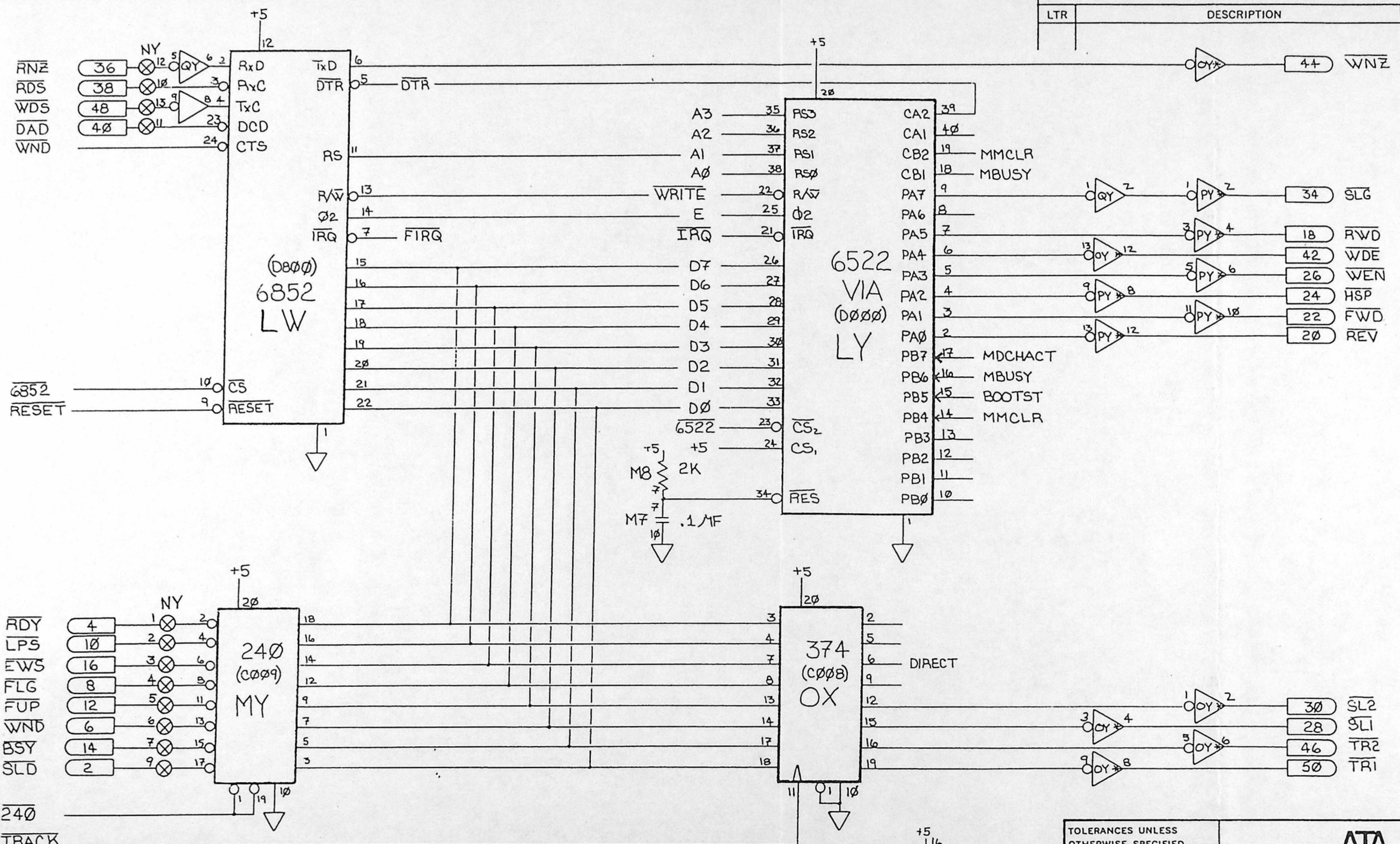
(section in binder
was empty)

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



TOLERANCES UNLESS OTHERWISE SPECIFIED			
FRACTIONS	DEC	ANGLES	
±	±	±	
APPROVALS	DATE	ATA Corp. COMPUTER IMAGE RPU/MAG TAPE INTERFACE 6809 CPU and Support	
DRAWN LPD	11/18/81		
CHECKED		SCALE	SIZE B
		DRAWING NO.	11119L1
DO NOT SCALE DRAWING			SHEET 1 of 8

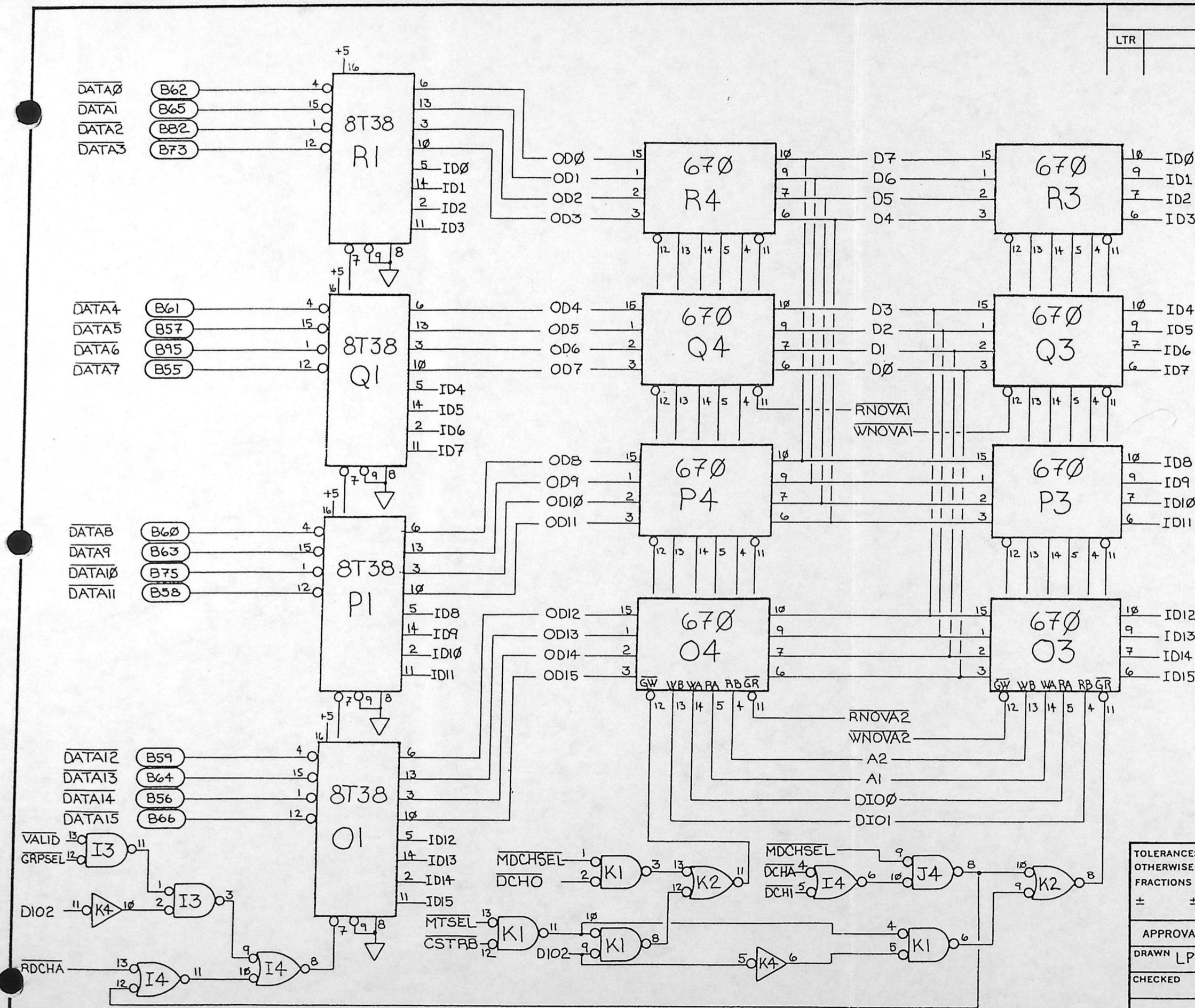
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTE: $\otimes$ = PIN # = 1-7, 9-15

TOLERANCES UNLESS OTHERWISE SPECIFIED			
FRACTIONS	DEC	ANGLES	
±	±	±	
APPROVALS	DATE	ATA Corp. COMPUTER IMAGE RPU/MAG TAPE INTERFACE TAPE Control, Status and R/W	
DRAWN LPD	11/19/81		
CHECKED			
SCALE	SIZE B	DRAWING NO. 11119L1	
DO NOT SCALE DRAWING			SHEET 2 of 8

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

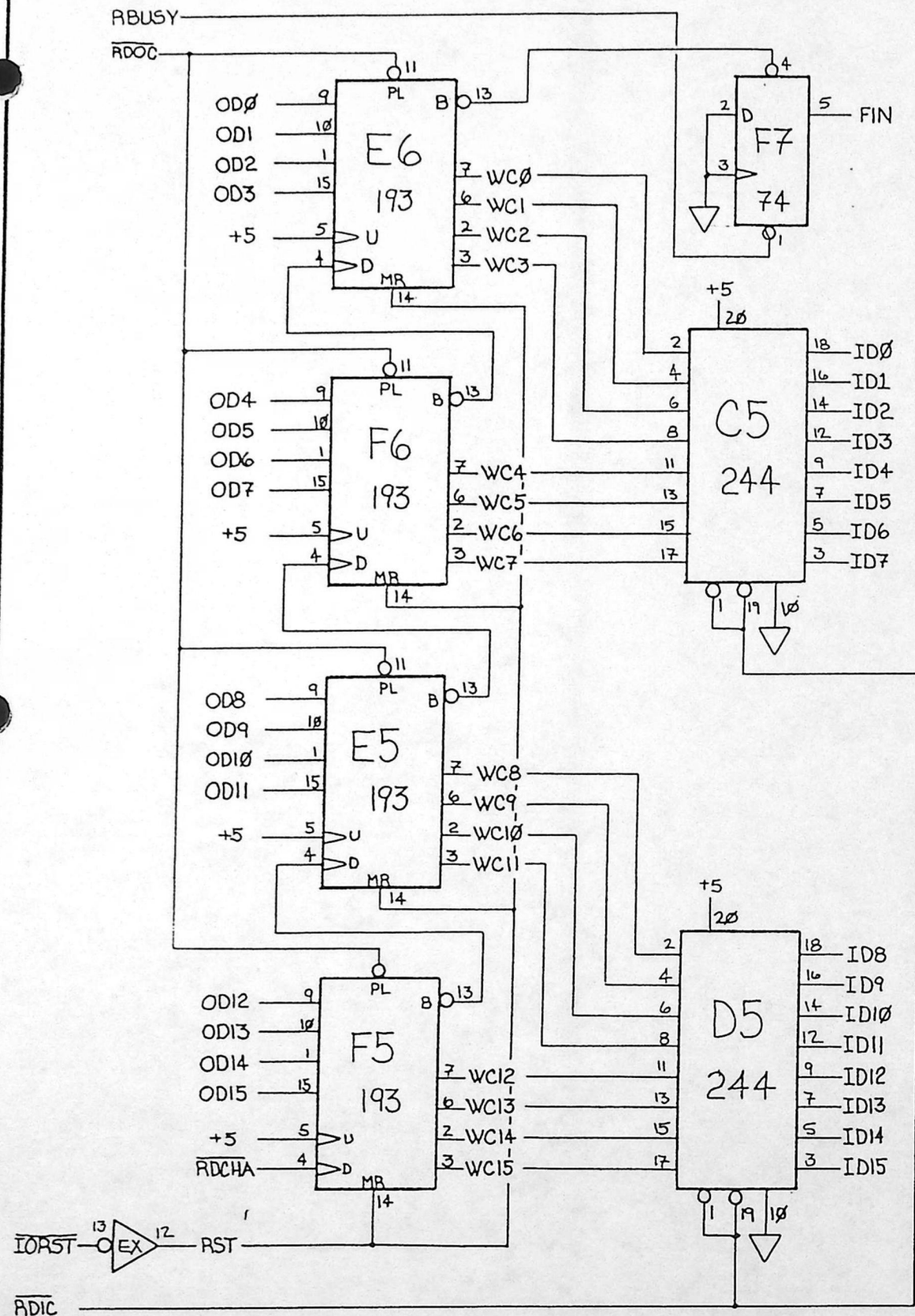


TOLERANCES UNLESS
OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

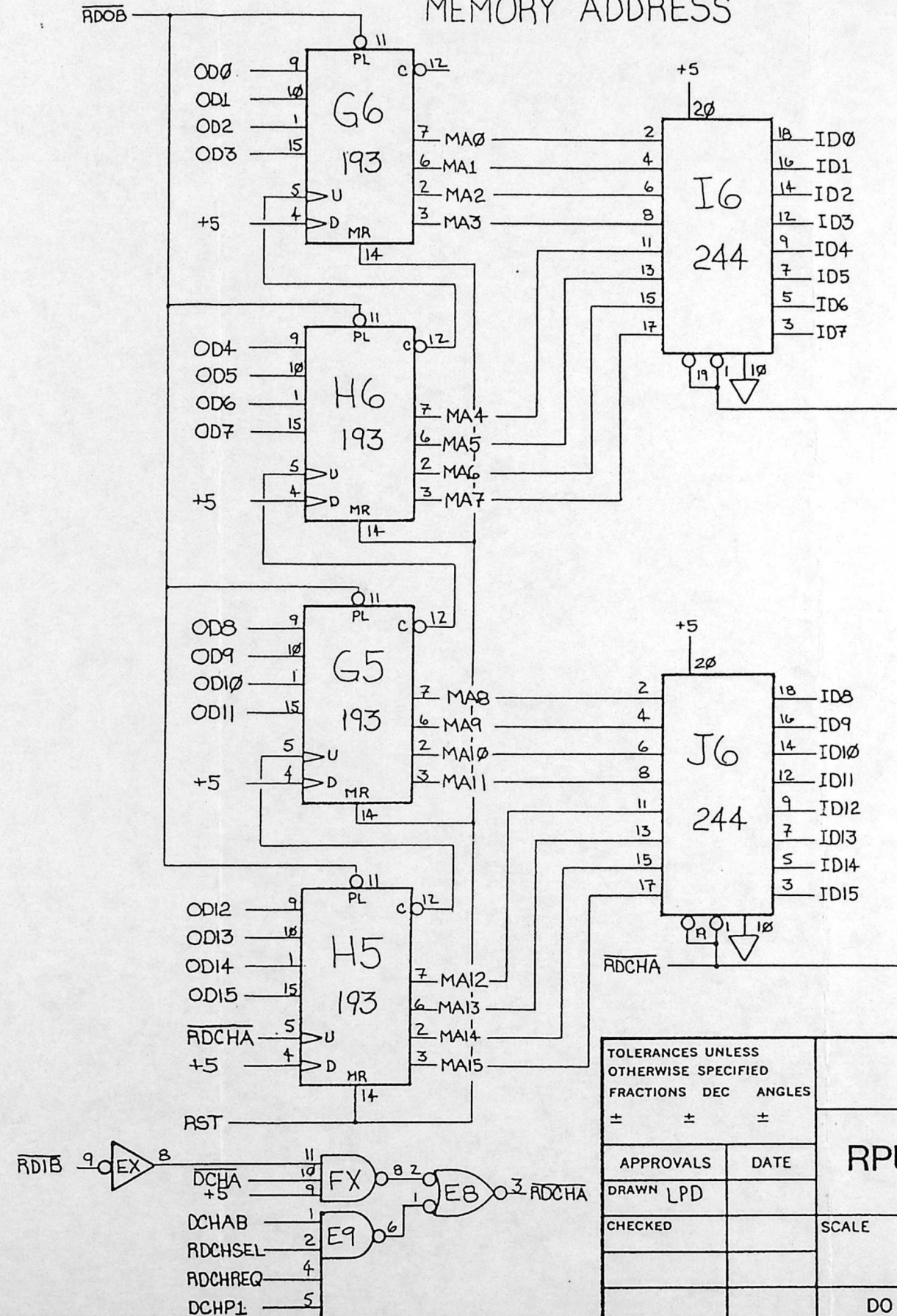
APPROVALS	DATE
DRAWN LPD	
CHECKED	

ATA Corp.			
COMPUTER IMAGE RPU/MAG TAPE INTERFACE			
DG Data - Buffers, Registers & Select			
SCALE	SIZE	DRAWING NO.	
	B	11119L1	
DO NOT SCALE DRAWING			SHEET 3 of 8

WORD COUNT



MEMORY ADDRESS



TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

APPROVALS	DATE
DRAWN LPD	
CHECKED	

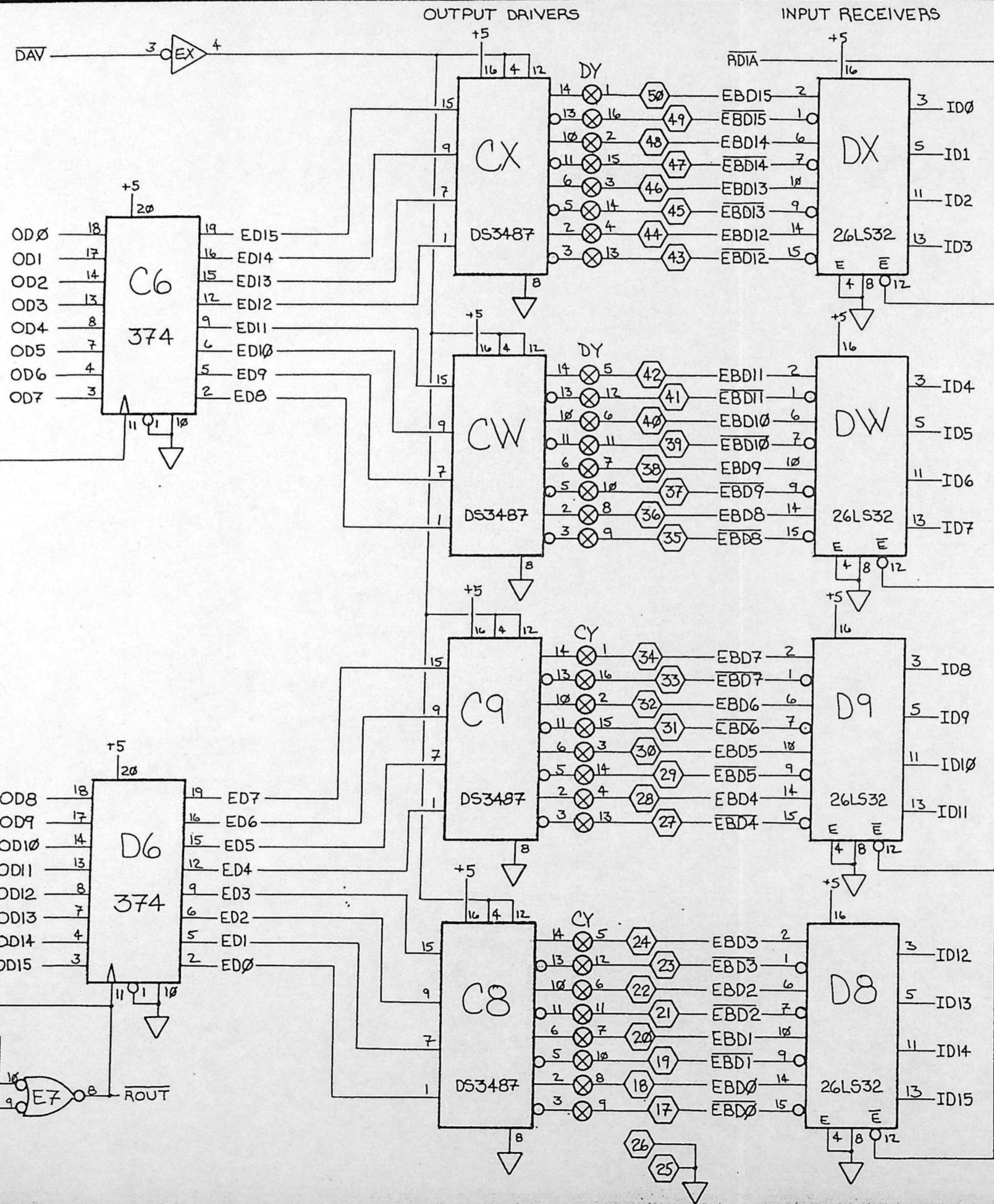
ATA Corp.

COMPUTER IMAGE
RPU/MAG TAPE INTERFACE

RPU DMA Counters

SCALE	SIZE	DRAWING NO.
	B	11119L1

DO NOT SCALE DRAWING SHEET 7 of 8



REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

+5P	C.5-20 D.W-16 E.7-14 F.X-14 F.3-14 G.6-16 I.2-14 J.3-14 K.W-16 L.4-24 M.6-14 N.4-16 O.Y-14 Q.4-16	C.6-20 D.9-16 E.8-14 F.W-14 F.2-16 G.7-14 I.3-14 J.2-14 K.X-2 L.3-22 M.7-16 N.3-14 P.Y-14 Q.Y-14	C.8-16 D.8-16 E.9-14 F.9-16 F.1-14 G.8-14 I.4-14 J.1-16 K.X-3 L.1-14 M.8-16 N.1-20 P.4-16 R.4-16	C.9-16 D.6-20 E.W-14 F.8-14 G.1-14 G.9-14 I.6-20 K.1-14 L.Y-20 M.1-14 M.Y-20 O.1-16 P.3-16 R.3-16	C.W-16 D.5-20 E.X-14 F.7-14 G.2-14 H.6-16 J.X-15 K.2-14 L.W-12 M.2-14 N.Y-16 O.3-16 P.1-16 R.1-16	C.X-16 E.5-16 E.Y-16 F.6-16 G.3-16 H.5-16 J.6-20 K.3-14 L.8-7 M.3-14 N.7-14 O.4-16 Q.1-16	D.X-16 E.6-16 F.Y-16 F.5-16 G.5-16 H.2-20 J.4-14 K.4-14 L.6-24 M.4-14 N.5-16 O.X-20 Q.3-16
+5	E.5-5 F.X-9 F.7-10 G.8-12 M.3-10	E.6-5 F.W-10 F.6-5 H.6-4 M.3-4	E.Y-4 F.W-4 F.5-5 H.5-4 M.4-12	E.Y-12 F.9-6 G.5-4 K.3-4 M.7-12	F.Y-4 F.8-2 G.6-4 L.Y-24 M.7-4	F.Y-12 F.8-4 G.8-4 L.6-21 N.5-6	F.X-5 F.8-10 G.8-10 L.4-21
-5V	*NB-81	K.X-12					
-GNDP	C.5-10 D.W-8 E.7-7 F.X-7 F.3-7 G.6-8 I.2-7 J.3-7 K.W-8 L.6-12 M.4-7 N.4-8 O.X-10 Q.3-8	C.6-10 D.9-8 E.8-7 F.W-7 F.2-8 G.7-7 I.3-7 J.2-7 K.X-9 L.4-12 M.6-7 N.3-7 O.Y-7 Q.4-8	C.8-8 D.8-8 E.9-7 F.9-8 F.1-7 G.8-7 I.4-7 J.1-8 K.X-14 L.3-11 M.7-1 N.1-10 P.Y-7 Q.Y-7	C.9-8 D.6-10 E.W-7 F.8-7 G.1-7 G.9-7 I.6-10 K.1-7 K.Y-1 L.1-7 M.Y-10 *CA-25 P.4-8 R.4-8	C.W-8 D.5-10 E.X-7 F.7-7 G.2-7 H.6-8 J.X-1 K.2-7 L.Y-1 M.1-7 N.Y-8 O.1-8 P.3-8 R.3-8	C.X-8 E.5-8 E.Y-8 F.6-8 G.3-8 H.5-8 J.6-10 K.3-7 L.W-1 M.2-7 N.7-7 O.3-8 P.1-8 R.1-8	D.X-8 E.6-8 F.Y-8 F.5-8 G.5-8 H.2-10 J.4-7 K.4-7 L.8-1 M.3-7 N.5-8 O.4-8 Q.1-8
-GND	C.6-1 F.7-3 H.2-15 I.1-4 N.7-3 N.1-17 R.1-9	D.X-4 F.2-5 H.2-16 J.X-16 N.1-16 N.7-12	D.W-4 G.7-2 H.1-4 J.X-17 N.1-19 *CA-26	D.9-4 G.7-12 H.1-6 K.3-12 N.1-2 O.1-9	D.8-4 H.1-2 I.1-2 M.7-10 N.1-3 O.X-1	D.6-1 H.2-19 I.1-8 M.7-6 N.1-4 P.1-9	F.7-2 H.2-18 I.1-6 N.7-2 N.1-5 Q.1-9
240/	M.Y-1	M.Y-19	N.4-7				
6522/	L.Y-23	N.5-13					
6852/	L.W-10	N.5-12					
A0	J.X-13	L.Y-38	L.8-8	L.6-8	L.4-8	L.3-7	N.4-1
A1	J.X-14 O.3-14	L.Y-37 O.4-5	L.W-11 P.4-5	L.8-9 P.3-14	L.6-7 Q.3-14	L.4-7 L.5	L.3-6 R.4-5

A1	R.3-14						
A10	K.W-1	L.8-18	L.6-19	L.4-19			
A11	K.W-2	L.8-19	N.5-1				
A12	K.W-3	L.8-20	N.5-2				
A13	K.W-4	L.8-21	N.5-3				
A14	K.4-3	L.8-22	K.W-5				
A15	K.4-1	L.8-23	K.W-6				
A2	L.Y-36 P.4-4	L.8-10 P.3-13	L.6-6 Q.3-13	L.4-6 Q.4-4	L.3-5 R.4-4	O.3-13 R.3-13	O.4-4
A3	L.Y-35	L.8-11	L.6-5	L.4-5	L.3-4	N.4-2	
A4	L.8-12	L.6-4	L.4-4	L.3-3	N.4-5		
A5	L.8-13	L.6-3	L.4-3	L.3-2			
A6	L.8-14	L.6-2	L.4-2	L.3-1			
A7	L.8-15	L.6-1	L.4-1	L.3-21			
A8	L.8-16	L.6-23	L.4-23	L.3-20			
A9	L.8-17	L.6-22	L.4-22	L.3-19			
BDCHO	E.X-10	F.X-4					
BOOTST	L.Y-15	N.7-5					
BSY/	*CB-14	M.Y-15	N.Y-7				
CA-1	B.Y-13	E.Y-15	*CA-1				
CA-2	B.Y-4	E.Y-14	*CA-2				
CLR	*NA-50	F.1-11					
CLR/	F.2-1	F.1-10					
CMD	E.7-3	F.Y-7					
CSTRB/	F.9-5	G.3-5	I.3-6	K.1-12			
D0	O.X-18 L.4-9	M.Y-3 L.3-8	L.Y-33 O.3-3	J.X-18 O.4-6	L.W-22 Q.4-6	L.8-31 Q.3-3	L.6-9
D1	O.X-17 L.4-10	M.Y-5 L.3-9	L.Y-32 O.3-2	J.X-19 O.4-7	L.W-21 Q.4-7	L.8-30 Q.3-2	L.6-10
D2	O.X-14 L.4-11	M.Y-7 L.3-10	L.Y-31 O.3-1	J.X-20 O.4-9	L.W-20 Q.4-9	L.8-29 Q.3-1	L.6-11

*MAG TAPE/RPU INT (MTRA.WR)

*9/22/81

PAGE

3

D3	O.X-13 L.4-13	M.Y-9 L.3-12	L.Y-30 O.3-15	J.X-21 O.4-10	L.W-19 Q.4-10	L.8-28 Q.3-15	L.6-13
D4	O.X-8 L.4-14	M.Y-12 L.3-13	L.Y-29 P.3-3	J.X-22 P.4-6	L.W-18 R.4-6	L.8-27 R.3-3	L.6-14
D5	O.X-7 L.4-15	M.Y-14 L.3-14	L.Y-28 P.3-2	J.X-23 P.4-7	L.W-17 R.4-7	L.8-26 R.3-2	L.6-15
D6	O.X-4 L.4-16	M.Y-16 L.3-15	L.Y-27 P.3-1	J.X-24 P.4-9	L.W-16 R.4-9	L.8-25 R.3-1	L.6-16
D7	O.X-3 L.4-17	M.Y-18 L.3-16	L.Y-26 P.3-15	J.X-25 P.4-10	L.W-15 R.4-10	L.8-24 R.3-15	L.6-17
DAD/	*CB-40	N.Y-11	L.W-23				
DATA0/	*NB-62	R.1-4					
DATA1/	*NB-65	R.1-15					
DATA10/	*NB-75	P.1-1	N.1-12				
DATA11/	*NB-58	N.1-11	P.1-12				
DATA12/	*NB-59	O.1-4	N.1-9				
DATA13/	*NB-64	O.1-15	N.1-8				
DATA14/	*NB-56	N.1-7	O.1-1				
DATA15/	*NB-66	N.1-6	O.1-12				
DATA2/	*NB-82	R.1-1					
DATA3/	*NB-73	R.1-12					
DATA4/	*NB-61	Q.1-4					
DATA5/	*NB-57	Q.1-15					
DATA6/	*NB-95	Q.1-1					
DATA7/	*NB-55	Q.1-12					
DATA8/	*NB-60	P.1-4					
DATA9/	*NB-63	P.1-15					
DATIA	*NA-44	F.1-3					
DATIA/	F.2-11	F.1-4					
DATIB	*NA-42	F.3-8					
DATIC	*NA-54	F.1-9					

DATIC/	F.2-13	F.1-8					
DATOA	*NA-58	F.1-13					
DATOA/	F.2-2	F.1-12					
DATOB	*NA-56	G.1-1					
DATOB/	F.2-3	G.1-2					
DATOC	*NA-48	G.1-3					
DATOC/	F.2-4	G.1-4					
DAV	E.X-3	F.Y-9	G.8-9	J.4-13			
DCHA/	*NA-60	H.1-3	I.3-10	I.4-4	F.X-10		
DCHAB	E.9-1	G.8-3	K.4-12	M.4-3	M.6-1		
DCHAB/	I.3-8	K.4-13					
DCHI	*NB-37	I.1-5	I.2-9				
DCHI/	I.2-8	I.4-5					
DCHMØ/	*NB-17	M.2-3					
DCHO	*NB-33	I.1-3	I.2-4				
DCHO/	E.X-11	I.2-6	K.1-2				
DCHP1	E.8-4	E.9-5	E.W-3				
DCHPIN	L.1-5	G.1-12	I.4-2	E.W-1	M.6-2		
DCHPIN/	*NA-94	G.1-13	J.1-5				
DCHPOUT/	*NA-93	J.1-2	L.1-6				
DCHR/	*NB-35	M.1-12	M.1-6				
DCHSYN	F.8-5	F.8-12					
DIOØ	F.9.1 Q.3-5	G.3-1 Q.4-14	G.2-10 R.4-14	O.3-5 R.3-5	O.4-14	P.4-14	P.3-5
DIO1	F.9-2 Q.3-4	G.3-2 Q.4-13	G.2-8 R.4-13	O.3-4 R.3-4	O.4-13	P.4-13	P.3-4
DIO2	F.9-3	G.2-4	G.3-3	K.4-5	K.4-11	K.1-9	
DIRECT	M.2-1	O.X-6					
DMA/	L.8-33	M.8-6					
DRQ	E.Y-5	F.8-3					

DS0/	*NA-72	H.2-17
DS1/	*NA-68	H.2-5
DS2/	*NA-66	H.2-4
DS3/	*NA-46	H.2-3
DS4/	*NA-62	H.2-2
DS5/	*NA-64	H.2-1
DTR/	L.Y-39	L.W-5

TOTAL NUMBER OF WIRE WRAPS: 1106

TOTAL PINS USED: 651

E	J.X-27	L.Y-25	L.W-14	L.8-34	N.4-6	Q.Y-13	
E.5-13	E.5-13	F.6-4					
E.6-13	E.6-13	F.7-4					
E.7-6	E.7-6	E.7-10					
E.8-11	E.8-11	F.8-1					
E.8-6	E.8-6	G.8-2					
E.8-8	E.8-8	E.8-12					
E.9-6	E.8-1	E.9-6					
E.X-4	C.8-4 C.X-4	C.8-12 E.X-4	C.9-12	C.9-4	C.W-4	C.W-12	C.X-12
E.X-8	E.X-8	F.X-11					
E/	F.3-12	J.4-2	L.4-20	L.6-20	Q.Y-12		
EBD0	*CA-18	C.Y-8	C.8-2	D.8-14			
EBD0/	*CA-17	C.Y-9	C.8-3	D.8-15			
EBD1	*CA-20	C.Y-7	C.8-6	D.8-10			
EBD1/	*CA-19	C.Y-10	C.8-5	D.8-9			
EBD10	*CA-40	D.Y-6	D.W-6	C.W-10			
EBD10/	*CA-39	D.Y-11	D.W-7	C.W-11			
EBD11	*CA-42	D.Y-5	D.W-2	C.W-14			
EBD11/	*CA-41	D.Y-12	D.W-1	C.W-13			
EBD12	*CA-44	D.Y-4	D.X-14	C.X-2			
EBD12/	*CA-43	D.Y-13	D.X-15	C.X-3			
EBD13	*CA-46	D.Y-3	D.X-10	C.X-6			
EBD13/	*CA-45	D.Y-14	D.X-9	C.X-5			
EBD14	*CA-48	D.Y-2	D.X-6	C.X-10			
EBD14/	*CA-47	D.Y-15	D.X-7	C.X-11			
EBD15	*CA-50	D.Y-1	D.X-2	C.X-14			
EBD15/	*CA-49	D.Y-16	D.X-1	C.X-13			
EBD2	*CA-22	C.Y-6	C.8-10	D.8-6			

EBD2/	*CA-21	C.Y-11	C.8-11	D.8-7
EBD3	*CA-24	C.Y-5	C.8-14	D.8-2
EBD3/	*CA-23	C.Y-12	C.8-13	D.8-1
EBD4	*CA-28	C.Y-4	C.9-2	D.9-14
EBD4/	*CA-27	C.Y-13	C.9-3	D.9-15
EBD5	*CA-30	C.Y-3	C.9-6	D.9-10
EBD5/	*CA-29	C.Y-14	C.9-5	D.9-9
EBD6	*CA-32	C.Y-2	C.9-10	D.9-6
EBD6/	*CA-31	C.Y-15	C.9-11	D.9-7
EBD7	*CA-34	C.Y-1	C.9-14	D.9-2
EBD7/	*CA-33	C.Y-16	C.9-13	D.9-1
EBD8	*CA-36	D.Y-8	D.W-14	C.W-2
EBD8/	*CA-35	D.Y-9	D.W-15	C.W-3
EBD9	*CA-38	D.Y-7	D.W-10	C.W-6
EBD9/	*CA-37	D.Y-10	D.W-9	C.W-5
EBUSY	*CA-16	B.Y-5	F.Y-14	
EBUSY/	*CA-15	B.Y-12	F.Y-13	
ECMD	*CA-12	B.Y-7	F.Y-6	
ECMD/	*CA-11	B.Y-10	F.Y-5	
ED0	C.8-1	D.6-2		
ED1	C.8-7	D.6-5		
ED10	C.6-6	C.W-9		
ED11	C.6-9	C.W-15		
ED12	C.6-12	C.X-1		
ED13	C.6-15	C.X-7		
ED14	C.6-16	C.X-9		
ED15	C.6-19	C.X-15		
ED2	C.8-9	D.6-6		
ED3	C.8-15	D.6-9		

ED4	C.9-1	D.6-12	
ED5	C.9-7	D.6-15	
ED6	C.9-9	D.6-16	
ED7	C.9-15	D.6-19	
ED8	C.6-2	C.W-1	
ED9	C.6-5	C.W-7	
EDAV	*CA-14	B.Y-6	F.Y-10
EDAV/	*CA-13	B.Y-11	F.Y-11
EDONE	*CA-7	B.Y-1	E.Y-1
EDONE/	*CA-8	B.Y-16	E.Y-2
EDRQ	*CA-6	B.Y-2	E.Y-6
EDRQ/	*CA-5	B.Y-15	E.Y-7
EFIN	*CA-10	B.Y-8	F.Y-2
EFIN/	*CA-9	B.Y-9	F.Y-3
ERDAV	*CA-4	B.Y-3	E.Y-10
ERDAV/	*CA-3	B.Y-14	E.Y-9
EXS/	*CB-16	N.Y-3	M.Y-6
F.2-14	F.2-14	H.1-1	I.3-4
F.2-15	F.2-15	F.1-5	
F.2-6	F.2-6	G.2-1	
F.2-7	F.2-7	G.2-5	
F.2-9	F.2-9	G.2-13	
F.3-10	F.3-10	F.2-12	
F.3-13	F.3-13	Q.Y-3	
F.5-13	E.5-4	F.5-13	
F.6-13	E.6-4	F.6-13	
F.X-6	E.7-9	F.X-6	
F.X-8	E.8-2	F.X-8	
FIN	F.Y-1	F.7-5	

FIRQ/	L.W-7	L.8-4	M.8-4
FLG/	*CB-8	M.Y-8	N.Y-4
FUP/	*CB-12	M.Y-11	N.Y-5
FWD	L.Y-3	P.Y-11	
FWD/	*CB-22	P.Y-10	
G.2-12	G.2-12	G.2-11	
G.2-2	G.2-2	G.2-3	
G.2-6	G.2-6	G.2-9	
G.5-12	G.5-12	H.6-5	
G.7-5	G.7-5	G.8-13	
G.9-11	G.9-11	G.9-10	
G.9-3	F.W-1	F.W-13	G.9-3
G.9-8	F.W-12	G.9-8	
GRPSEL/	H.2-14	I.3-12	
H.1-12	E.7-12	H.1-12	H.1-11
H.1-14	H.1-14	H.1-13	I.3-9
H.1-16	H.1-16	H.1-15	I.3-5
H.6-12	G.6-5	H.6-12	
H5.12	G.5-5	H.5-12	
HALT/	L.8-40	M.8-5	
HSP	L.Y-4	P.Y-9	
HSP/	*CB-24	P.Y-8	
I.1-10	I.1-10	I.1-9	I.2-13
I.1-12	I.1-12	I.1-11	I.2-10
I.1-14	I.1-14	I.1-13	I.2-5
I.1-16	I.1-16	I.1-15	I.2-2
I.2-11	I.2-11	N.1-15	
I.3-11	I.3-11	I.3-1	
I.3-3	I.3-3	I.4-9	

I.4-11	I.4-11	I.4-10			
I.4-3	I.4-3	M.4-2			
I.4-6	I.4-6	J.4-10			
I.4-8	I.4-8	O.1-7	P.1-7	Q.1-7	R.1-7
ID0	D.X-3	C.5-18	I.6-18	R.3-10	R.1-5
ID1	D.X-5	C.5-16	I.6-16	R.3-9	R.1-14
ID10	D.9-11	D.5-14	J.6-14	P.3-7	P.1-2
ID11	D.9-13	D.5-12	J.6-12	P.3-6	P.1-11
ID12	D.8-3	D.5-9	J.6-9	O.1-5	O.3-10
ID13	D.8-5	D.5-7	J.6-7	O.1-14	O.3-9
ID14	D.8-11	D.5-5	J.6-5	O.1-2	O.3-7
ID15	D.8-13	D.5-3	J.6-3	O.1-11	O.3-6
ID2	D.X-11	C.5-14	I.6-14	R.3-7	R.1-2
ID3	D.X-13	C.5-12	I.6-12	R.3-6	R.1-11
ID4	D.W-3	C.5-9	I.6-9	Q.1-5	Q.3-10
ID5	D.W-5	C.5-7	I.6-7	Q.1-14	Q.3-9
ID6	D.W-11	C.5-5	I.6-5	Q.1-2	Q.3-7
ID7	D.W-13	C.5-3	I.6-3	Q.1-11	Q.3-6
ID8	D.9-3	D.5-18	J.6-18	P.3-10	P.1-5
ID9	D.9-5	D.5-16	J.6-16	P.3-9	P.1-14
INTA	*NA-40	I.1-7	I.2-12		
INTP1	E.W-6	G.9-13			
INTPIN	E.W-4	G.1-10	K.2-2	L.1-1	
INTPIN/	*NA-96	J.1-4	G.1-11		
INTPOUT/	*NA-95	J.1-1	L.1-3		
INTR/	*NB-29	M.1-10	M.1-4		
IOPULSE	*NA-74	E.7-13	H.1-5		
IORST	*NA-70	I.1-1	I.2-1		
IORST/	E.X-13	E.8-13	F.8-13	F.7-13	G.8-1
					G.9-5
					I.2-3

*MAG TAPE/RPU INT (MTRB.WR)

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IORST/	J.3-2 N.3-13	J.3-9	M.3-13	M.4-1	M.7-2	N.7-1	N.7-13
IRQ/	L.Y-21	L.8-3	M.8-3				
J.3-11	J.3-11	J.3-10					
J.3-3	J.3-3	J.3-4	K.3-13				
J.3-6	J.3-6	K.3-1	M.3-1				
J.3-8	J.3-8	N.3-1					
J.4-11	J.4-11	J.2-4					
J.4-8	I.4-12	J.4-8	K.2-10				
J.Y-1	J.Y-1	J.X-6					
J.Y-16	J.Y-16	J.X-7					
K.1-11	K.1-11	K.1-10	K.1-4				
K.1-3	K.1-3	K.2-13					
K.1-6	K.1-6	K.2-9					
K.1-8	K.1-8	K.2-12					
K.2-11	K.2-11	O.4-12	P.4-12	Q.4-12	R.4-12		
K.2-3	K.2-3	K.2-4					
K.2-6	K.2-6	M.3-2					
K.2-8	K.2-8	O.3-11	P.3-11	Q.3-11	R.3-11		
K.4-10	I.3-2	K.4-10					
K.4-2	K.4-2	N.5-5					
K.4-4	K.4-4	N.5-4					
K.4-6	K.1-5	K.4-6					
K.W-15	K.W-15	J.X-3					
K.X-1	K.X-1	K.X-4					
K.X-5	K.X-5	K.X-6	K.X-7				
K.X-15	K.X-15	K.X-10	K.X-11				
L.Y-34	L.Y-34	M.8-7	M.7-7				
L.Y-9	L.Y-9	Q.Y-1					

LPS/	*CB-10	N.Y-2	M.Y-4			
LPTSEL/	H.2-11	H.2-7				
M.7-3	M.1-1	M.7-3				
M.7-5	M.7-5	M.7-15	M.7-14	M.7-11		
M.8-11	M.8-11	M.4-4	N.3-2	N.3-4	N.3-10	
M.8-12	G.3-6	M.8-12				
MA0	G.6-7	I.6-2				
MA1	G.6-6	I.6-4				
MA10	G.5-2	J.6-6				
MA11	G.5-3	J.6-8				
MA12	H.5-7	J.6-11				
MA13	H.5-6	J.6-13				
MA14	H.5-2	J.6-15				
MA15	H.5-3	J.6-17				
MA2	G.6-2	I.6-6				
MA3	G.6-3	I.6-8				
MA4	H.6-7	I.6-11				
MA5	H.6-6	I.6-13				
MA6	H.6-2	I.6-15				
MA7	H.6-3	I.6-17				
MA8	G.5-7	J.6-2				
MA9	G.5-6	J.6-4				
MADEN/	J.3-13	M.6-6	Q.Y-11			
MBUSY	L.1-10	J.3-12	K.3-2	K.3-9	L.Y-18	L.Y-16
MCLR/	G.3-12	J.3-1	N.7-10			
MDATOA/	G.3-13	N.7-4				
MDCHACT	L.Y-17	M.4-9				
MDCHACT/	M.4-10	N.4-9				
MDCHREQ	I.4-1	M.6-4	M.1-5	N.3-9		

MDCHREQ/ E.W-2	L.1-4	M.4-11	N.3-8		
MDCHSEL M.2-2	M.4-5	M.6-5			
MDCHSEL/ J.4-9	K.1-1	M.4-6			
MDCHSYN N.3-5	N.3-12				
MDONE K.2-1	K.3-11	K.3-5	L.1-13		
MINTDIS/ K.2-5	M.3-8				
MINTREQ M.3-5	M.1-3	N.1-1			
MINTREQ/ E.W-5	M.3-6	L.1-2			
MMCLR L.Y-14	L.Y-19	N.7-9			
MRDY/ L.8-36	M.8-13				
MSKO F.7-11	G.1-8	M.3-11			
MSKO/ *NA-38	G.1-9				
MSTART/ G.3-7	J.3-5	K.3-10	N.7-11		
MTSEL K.4-8	L.1-9	L.1-12			
MTSEL/ G.3-4	H.2-6	K.1-13	K.4-9		
N.5-14 F.3-11	N.5-14				
NMI/ J.X-26	L.8-2	M.8-2			
OD0 C.6-18	E.6-9	G.6-9	R.4-15	R.1-6	
OD1 C.6-17	E.6-10	G.6-10	R.4-1	R.1-13	
OD10 D.6-14	E.5-1	G.5-1	M.3-12	P.4-2	P.1-3
OD11 D.6-13	E.5-15	G.5-15	P.4-3	P.1-10	
OD12 D.6-8	F.7-12	F.5-9	H.5-9	O.1-6	O.4-15
OD13 D.6-7	F.5-10	H.5-10	O.1-13	O.4-1	
OD14 D.6-4	F.5-1	H.5-1	O.1-3	O.4-2	
OD15 D.6-3	F.5-15	H.5-15	O.1-10	O.4-3	
OD2 C.6-14	E.6-1	G.6-1	R.4-2	R.1-3	
OD3 C.6-13	E.6-15	G.6-15	R.4-3	R.1-10	
OD4 C.6-8	F.6-9	H.6-9	Q.1-6	Q.4-15	
OD5 C.6-7	F.6-10	H.6-10	Q.1-13	Q.4-1	

OD6	C.6-4	F.6-1	H.6-1	Q.1-3	Q.4-2		
OD7	C.6-3	F.6-15	H.6-15	Q.1-10	Q.4-3		
OD8	D.6-18	E.5-9	G.5-9	P.4-15	P.1-6		
OD9	D.6-17	E.5-10	G.5-10	P.4-1	P.1-13		
PULSE	E.7-1	E.7-11					
Q.Y-10	F.3-9	Q.Y-10					
RAM/	J.4-1	N.5-10					
RAME/	J.4-3	L.3-18					
RBUSY	E.8-10	F.Y-15	F.W-2	F.7-1	G.7-9	J.4-12	
RCLR/	F.9-12	G.9-4					
RDAV	E.Y-11	G.7-3					
RDCHA/	E.8-9 J.6-1	E.8-3 J.6-19	F.5-4	H.5-5	I.4-13	I.6-1	I.6-19
RDCHREQ	F.X-5	F.8-9	E.8-5	E.9-4	M.1-13		
RDCHSEL	E.9-2	F.X-3	G.8-5				
RDGSEL/	N.5-15	N.4-4					
RDIA/	D.X-12	D.W-12	D.9-12	D.8-12	F.9-9		
RDIB/	E.X-9	F.9-10					
RDIC/	C.5-1	C.5-19	D.5-1	D.5-19	F.9-11		
RDOA/	E.7-4	F.9-13					
RDOB/	F.9-14	G.5-11	G.6-11	H.6-11	H.5-11		
RDOC/	E.5-11	E.6-11	E.7-5	F.9-15	F.6-11	F.5-11	
RDONE	F.W-5	G.7-11	G.9-12	J.2-1			
RDS/	*CB-38	L.W-3	N.Y-10				
RDY/	*CB-4	M.Y-2	N.Y-1				
RESET/	J.X-4	L.W-9	L.8-37	M.1-2	M.8-1		
REV	L.Y-2	P.Y-13					
REV/	*CB-20	P.Y-12					
RINTDIS/	F.7-8	G.9-9					

RINTREQ	F.W-9	M.1-11	N.1-18				
RNOVA1/	N.4-11	Q.4-11	R.4-11				
RNOVA2/	N.4-10	O.4-11	P.4-11				
RNZ	L.W-2	Q.Y-6					
RNZ/	*CB-36	N.Y-12	Q.Y-5				
ROM1/	L.4-18	N.5-9					
ROM2/	L.6-18	N.5-7					
ROUT/	C.6-11	D.6-11	E.7-8	G.7-4	G.8-11		
RPUCLR/	G.7-13	G.7-1	G.9-6	G.9-2			
RQENB	F.W-11	F.8-11	G.1-6	M.3-3	N.3-11		
RQENB/	*NB-41	G.1-5					
RS232IN	K.X-8	K.Y-2					
RS232OUT	K.X-13	K.Y-14					
RSEL	E.X-2	E.7-2	J.2-5	J.2-2			
RSEL/	E.X-1	F.9-4	H.2-13				
RST	H.5-14 E.5-14	H.6-14 E.X-12	G.6-14	G.5-14	F.5-14	F.6-14	E.6-14
RSTRT/	F.9-7	G.7-10	G.9-1				
RWD	L.Y-7	P.Y-3					
RWD/	*CB-18	P.Y-4					
RX	K.X-17	K.X-16	J.X-12				
SDCHRQ/	M.4-13	N.4-12	N.3-3				
SELB/	*NA-82	J.2-6	L.1-8				
SELD/	*NA-80	J.2-3	L.1-11				
SL1	O.X-15	O.Y-3					
SL1/	*CB-28	O.Y-4					
SL2	O.X-12	O.Y-1					
SL2/	*CB-30	O.Y-2					
SLD/	*CB-2	M.Y-17	N.Y-9				

SLG	P.Y-1	Q.Y-2
SLG/	*CB-34	P.Y-2
SMDONE/	K.3-3	Q.Y-4
SRDONE/	E.Y-3	F.W-3
STRT	*NA-52	F.1-1
STRT/	F.2-10	F.1-2
TR1	O.X-19	O.Y-9
TR1/	*CB-50	O.Y-8
TR2	O.X-16	O.Y-5
TR2/	*CB-46	O.Y-6
TRACK/	N.4-13	O.X-11
VALID/	F.1-6	I.3-13
WC0	C.5-2	E.6-7
WC1	C.5-4	E.6-6
WC10	D.5-6	E.5-2
WC11	D.5-8	E.5-3
WC12	D.5-11	F.5-7
WC13	D.5-13	F.5-6
WC14	D.5-15	F.5-2
WC15	D.5-17	F.5-3
WC2	C.5-6	E.6-2
WC3	C.5-8	E.6-3
WC4	C.5-11	F.6-7
WC5	C.5-13	F.6-6
WC6	C.5-15	F.6-2
WC7	C.5-17	F.6-3
WC8	D.5-2	E.5-7
WC9	D.5-4	E.5-6
WDE	L.Y-6	O.Y-13

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WDE/	*CB-42	O.Y-12				
WDS	L.W-4	Q.Y-8				
WDS/	*CB-48	N.Y-13	Q.Y-9			
WEN	L.Y-5	P.Y-5				
WEN/	*CB-26	P.Y-6				
WND/	*CB-6	L.W-24	M.Y-13	N.Y-6		
WNOVA1/	N.4-15	Q.3-12	R.3-12			
WNOVA2/	N.4-14	O.3-12	P.3-12			
WNZ	L.W-6	O.Y-11				
WNZ/	*CB-44	O.Y-10				
WRITE/	J.X-28	L.Y-22	L.W-13	L.8-32	L.3-17	N.4-3
XTAL1	L.8-38	M.9-1				
XTAL2	L.8-39	M.9-2				

TOTAL NUMBER OF WIRE WRAPS: 1340

TOTAL PINS USED: 998

* MAG TAPE INTERFACE PROGRAM
 * 12/18/80 B. UNDERHILL

* M6809 I/O DEFINITIONS

* RAM \$E800
 * ROM1 \$F000
 * ROM2 \$F800

* REGISTERS WHICH COMMUNICATE WITH THE NOVA

C004	ZNAH	EQU	\$C004	NOVA DOA/DIA, HIGH ORDER
C005	ZNAL	EQU	\$C005	LOW ORDER (WRITE SETS 'DIA', READ
C002	ZNBH	EQU	\$C002	NOVA DOB/DIB
C003	ZNBL	EQU	\$C003	
C000	ZNCH	EQU	\$C000	NOVA DOC/DIC
C001	ZNCL	EQU	\$C001	
C006	ZNDH	EQU	\$C006	NOVA DATA CHANNEL IN/OUT
C007	ZNDL	EQU	\$C007	

* OTHER NOVA RELATED LINES

C800	ZDONE	EQU	\$C800	WRITE: SET 'DONE' TO THE NOVA
C009	ZDCHR	EQU	\$C009	WRITE: SET DATA CHANNEL REQ
C008	ZDCHC	EQU	\$C008	READ: SET THE DCH CYCLE COMPLETE F

* 6522 PIA LINES

D001	ZPORTA	EQU	\$D001	PORT A - OUTPUTS TO DRIVE
*			BIT 0	REVERSE MOTION
*			1	FORWARD
*			2	HIGH SPEED (EITHER DIRECTION)
*			3	WEN- WRITE ENABLE & ERASE ON
*			5	RWD- REWIND (COMPLETES AUTOMATICALLY
*			7	SLG*- SELECT GATE TO DRIVE- ENABLES
D000	ZPORTB	EQU	\$D000	PORT B- 3 INPUTS
*			5	INPUT BOOT STATE- 0 IF BOOT
*			6	INPUT MBUSY- 1 IF NOVA HAS SET BUSY
*			7	INPUT MDCHACT- 1 IF DATA CHANNEL CY
D003	ZDIRA	EQU	\$D003	DIRECTION REGISTER FOR PORT A
D002	ZDIRB	EQU	\$D002	DDR FOR B, 0=INPUT, 1=OUTPUT
D008	T2LOL	EQU	\$D008	TIMER#2 LO ORD LATCH
D009	T2HOC	EQU	\$D009	TIMER #2 HI ORD COUNTER
D00B	T2ACR	EQU	\$D00B	TIMER #2 CONTROL REG
D00C	ZCTRL	EQU	\$D00C	PERIPH CTRL REGISTER, CONTAINS \$11
D00D	ZINT	EQU	\$D00D	INTERRUPT FLAGS REGISTER (READ)
D00E	ZINTE	EQU	\$D00E	INTERRUPT ENABLE BITS REGISTER (WR

* LATCH BUFFER OUTPUTS

C008	DPORTB	EQU	\$C008	
*				* BITS 0-3 OUTPUTS TO DRIVE
*			BIT 0	TR1 TRACK SEL
*			1	TR2 0=T1, 1=T2, 2=T3, 3=T4
*			2	SL1- DRIVE SELECT
*			3	SL2
*				* BIT 5 CONTROLS DATA CHANNEL DIRECTION
*			5	DATA CHAN DIRECTION- 0=OUTPUT FROM N
*				* INPUTS FROM DRIVE VIA THE 240
C009	ZR240	EQU	\$C009	READS THE 240
*			BIT 0 [1]	SLD- ADDRESS RECEIVED
*			1 [2]	BSY- FWD, REV, OR REWINDING
*			2 [4]	WND- WRITE ENB IS

ATA CORPORATION

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*          3 [8]  FUP- TAPE IN & UNPROTECTED
*          4 [10] FLG- HAS REWOUND OR LOADED
*          5 [20] EWS- EARLY WARNING SENSE, EOT
*          6 [40] LPS- LOAD PT SENSED IN REV (BOT)
*          7 [80] RDY- TAPE IN & LAMP ON & +5 OK

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* 6852 USRT REGISTERS
D800 ZSYNC0 EQU $D800

```

```

*          BIT 0
*          1
*          2
*          3
*          4
*          5
*          6
*          7

```

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D802 ZSYNC1 EQU $D802

```

```

*          BIT 0
*          1
*          2
*          3
*          4
*          5
*          6
*          7

```

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STATUS (READ) ----- CTRL1 (WRI
RCVR DA          1=RCVR RESET
XMT TDRA         1=XMTR RESET
(DCD) DAD        STRIP SYNC
(CTS) WND        CLEAR SYNC
XMT UNDERFLO    T INT ENB =0
OV ERR          R INT ENB =0
PAR ERR         AC1 (SEL OUTP REG
INTR REQ        AC2 (FOR ZSYNC1)

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DATA REGISTER
READ: GETS INPUT DATA BYTE
WRITE: IT IS ONE OF 4 REGISTERS
WRITE REG3: OUTPUT DATA BYTE
WRITE REG2: SYNC CODE
WRITE REG0 ----- REG1 CODES ARE:
PC1 (=0)          INT/EXT (=0)
(DTR*) WDE*       NSYNC (=1)
NBYTES (=1)      CLR CTS
WS1              CLR TUF
WS2              X
WS3              X
XMT SYNC ON UF   X
ERR INTR (=0)    X

```

```

* NOTE- INITIAL START MUST GO TO 'INIT'
* FAST INTERRUPT MUST GO TO 'FIRQ'

```

* RAM ALLOCATIONS

* THE BASE (DIRECT ADDRESSING) PAGE IS DEFINED AT LOC 0

* BUT WILL BE AT E800 AT RUN TIME (DP=\$E8)

0000		ORG	\$00	DIRECT PAGE- RUNS AT E800
0000	0002	XX	RMB 2	TEMP
0002	0002	YY	RMB 2	TEMP
0004	0001	TMPA	RMB 1	TEMPORARY- FOR TEST PROGRAMS
0005	0002	TIMO	RMB 2	TIMEOUT COUNTER FOR READ ROUTINE
0007	0002	NOVCOM	RMB 2	NOVA COMMAND (DOA)
0009	0002	NOVADD	RMB 2	NOVA'S DMA ADDRESS
000B	0002	NOVWC	RMB 2	NOVA'S WORD COUNT (NEGATIVE)
000D	0002	STATUS	RMB 2	DIA STATUS TO NOVA

* THIS IS A LATCH FOR BITS 1 3 5 7 10 14
 * THE OTHERS ARE READ DIRECTLY FROM STATUS
 * LINES WHEN NEEDED

* STATUS BITS ARE: (UPPER BYTE)

* BIT 7 [NOVA 0] ERROR- AN ERR BIT IS ON

* 6 [1] *DATA LATE DURING LAST READ

* 5 [2] REWINDING

* 4 [3] *ILLEGAL COMMAND

* 3 [4] HI DENSITY- ALWAYS 1

* 2 [5] *PARITY ERROR

* 1 [6] *EOT- ERROR IF FWD MOTION REQ.

* 0 [7] *FILE MARK (ERROR)

* LOWER BYTE

* 7 [8] BOT (ERROR ONLY IF REVERSE)

* 6 [9] 9-TRACK- ALWAYS 1

* 5 [10] *BAD TAPE

* 4 [11]

* 3 [12]

* 2 [13] WRITE LOCK (ERROR ONLY IF WRITE)

* 1 [14] *ODD CHARACTER

* 0 [15] READY

* NOTE: ERROR BIT IS ALWAYS ON IF A STARRED
 * BIT IS ON. IT ALSO MAY BE SET BY OTHER
 * CONDITIONS DURING AN OPERATION. WILL STAY
 * SET TILL NEXT OPERATION OR RESET.

0008 STATI EQU \$08 DEFAULT VALUE FOR STATUS

0040 STAT1I EQU \$40 " " FOR STATUS 1 = 9 TRACK

00DF LACHH EQU \$DF LATCHED BITS IN UPPER BYTE

0062 LACHL EQU \$62 LATCHED BITS IN LOWER

0057 ERRBH EQU \$57 BITS THAT CAN CAUSE THE ERROR BIT

0022 ERRBL EQU \$22 TO GO ON

000F 0001 MPORTB RMB 1 MEMORY IMAGE OF DPORTB

0010 0001 PARITY RMB 1 'OR' OF STATUS BYTES HAVING PAR. E

0011 0001 LRCC RMB 1 LRCC OF A RECORD

0012 0001 FSEEN RMB 1 NO OF FILEMARKS SEEN SINCE REW.

0013 0001 PECNT RMB 1 NO OF BYTES WITH PARITY ERROR

0014 0001 LCOMM RMB 1 LAST COMMAND ISSUED

0015 0001 ECHAR RMB 1

0016 0001 FCHAR RMB 1

0017 0001 ERRBIT RMB 1 FIRST CHAR OF A RECORD- 22 OR 55 (

0018 0001 INTRW RMB 1 TEMP- BITS THAT CAUSE ERROR FLAG I

0019 0001 READSP RMB 1 INTERRUPT IS HANDLING READ(0) WRIT

001A 0002 RECCNT RMB 2 0=READ, 1=SPACE REV, 2=SPACE FWD

001C 0001 TAPDIR RMB 1 RECORD COUNTER FOR SPACING

001D 0001 RSYNC RMB 1 TAPE DIRECTION: 2=FWD, 1=REV

001E 0001 RFMAR RMB 1 READ SYNC CHAR NOW BEING USED

FILE MARK CHAR ARE LOOKING FOR

001F	0001	EOTBIT	RMB	1
0020	0001	COUNT	RMB	1
0021	0001	WRITOK	RMB	1
0022	0001	NPAGW	RMB	1
0023	0001	NPAGR	RMB	1
0024	0002	TEMPY	RMB	2
0026	0001	BSYSET	RMB	1
0027	0002	PSCNT	RMB	2
E860			ORG	\$E860
E860	000C	POSTAM	RMB	12
E900			ORG	\$E900
E900	0200	BUFF	RMB	512
EB00	0000	BUFTOP	RMB	0
	EB40	BUFTR	EQU	\$EB40
	EBFF	RAMTOP	EQU	\$EBFF

*

*

* NOTE- DEBUGGER USES RAM FROM E830 TO E858

MASK FOR TESTING EOT/BOT
FOR WRITE ROUTINE
0 IF READ-AFTER-WRITE ERRORS
N PAGES TO WRITE
N PAGES TO READ-AFTER-WRITE
HOLDS Y TEMPORARILY (WRITE)
RAM FLAG TO INDICATE ECLIPSE SET
WRITE POSTAMBLE COUNT

POSTAMBLE

IS MEM BUFFER

(TOP OF BUFFER)+1
ADJUSTABLE BUFF TOP FOR READIN
LAST LOC IN RAM- STACK TOP

OPT G

FORM FCB'S

* BEGINNING OF CODE

* NOTE- DEBUGGER ROM IS ASSUMED TO BE IN F000-F7FF

F800			ORG	\$F800	
F800	10CE	EBFF	INIT	LDS	#RAMTOP
F804	86	E8	LDA	#\$E8	INITIALIZE STACK
F806	1F	8B	TFR	A,DP	SET THE DIRECT PAGE REG. TO
F808	86	08	LDA	#STATI	ADD HIGH DENSITY BIT
F80A	97	0D	STA	STATUS	CLEAR STATUS LATCHES
F80C	86	40	LDA	#STAT1I	ADD 9 TRACK BIT
F80E	97	0E	STA	STATUS+1	
F810	AD	9F F7FE	JSR	[\$F7FE]	***** INITIALIZE DEBUG *****
F814	BD	FDC9	JSR	SELU0	SET UP & INITIALIZE ALL
F817	1C	EF	ANDCC	#\$EF	ENABLE IRQ

*

* MAIN LOOP

* KEEP STATUS UP TO DATE, NOVA MAY BE READING IT

* LOOK FOR A COMMAND ISSUED

F819	BD	FE11	MAIN	JSR	SHOW	MAINTAINS DIA STATUS
F81C	96	26	LDA	BSYSET		SEE IF NOVA BUSY HAS BEEN SET
F81E	26	09	BNE	CMDISU		IF SET, COMMAND HAS BEEN ISSUED
F820	B6	D000	LDA	ZPORTB		SEE NON LATCHED BUSY
F823	85	40	BITA	#\$40		
F825	26	02	BNE	CMDISU		YES GO DO COMMAND
F827	20	F0	BRA	MAIN		NO, JUST LOOP AROUND

* A COMMAND HAS BEEN ISSUED

* FIND OUT WHAT, DISPATCH & DO IT

* FIRST CHECK TO SEE IF A BOOT CONDITION -

* - NO DOA, DOB, DOC. THESE VALUES HAVE TO BE

* - SET UP FOR A BOOT

F829	4F		CMDISU	CLRA	
F82A	97	26	LDA 2R240	STA	BSYSET
F82C	86	02	BPL 11LE9	LDA	#2
F82E	97	1C	STA	TAPDIR	RESET "BUSY"
F830	86	70	LDA	#\$70	DIRECTION ALMOST ALWAYS FWD
F832	97	1D	STA	RSYNC	SYNC CHAR, ALMOST ALWAYS 70
F834	86	55	LDA	#\$55	FILE MARK CHAR- 55 IF FWD
F836	97	1E	STA	RFMAR	
F838	86	20	LDA	#\$20	USUALLY, TEST FOR EWS (FWD)
F83A	97	1F	STA	EOTBIT	
F83C	B6	D000	LDA	ZPORTB	
F83F	85	20	BITA	#\$20	CHECK BOOT BIT
F841	27	2C	BEQ	BOOT	IF CLEAR DO BOOT

* NOT BOOT - NOW, CLEAR ALL THE LATCHED STATUS (ERROR) BITS

* COPY THE DOA, DOB, DOC VALUES INTO MEMORY

F843	86	08	LDA	#STATI	GET INIT VAL
F845	97	0D	STA	STATUS	CLEAR THE LATCH BITS
F847	86	40	LDA	#STAT1I	
F849	97	0E	STA	STATUS+1	(CLEAR ALL)
F84B	BD	FE11	JSR	SHOW	BRING STATUS UP TO DATE
F84E	FC	C002	LDD	ZNBH	COPY THE DOB
F851	DD	09	STD	NOVADD	
F853	FD	C002	STD	ZNBH	PUT IN DIB ALSO
F856	FC	C000	LDD	ZNCH	COPY THE DOC
F859	27	02	BEQ	SAVWC	IF WORD CNT=0 LEAVE IT
F85B	8A	80	ORA	#\$80	ELSE SET HIGH ORDER BITS
F85D	DD	0B	STD	NOVWC	
F85F	FC	C004	LDD	ZNAH	COPY THE DOA
F862	DD	07	STD	NOVCOM	

F864 C4	38	ANDB	#\$38	EXTRACT THE 3 COMMAND BITS
F866 D7	14	STB	LCOMM	SAVE COMMAND VALUE
F868 57		ASRB		GET THEM INTO BITS 3,2,1
F869 57		ASRB		
F86A 8E	F88E	LDX	#DISPA	GO TO THE RIGHT ROUTINE
F86D 6E	95	JMP	[B,X]	

* BOOT ROUTINE - SOMEBODY HIT THE PROGRAM LOAD SWITCH

F86F BD	F8F0	BOOT	JSR	REWI	REWIND FIRST
F872 B6	C009	BOOT2	LDA	ZR240	WAIT FOR FLAG TO COME UP
F875 85	10		BITA	#\$10	FROM DEI
F877 27	F9		BEQ	BOOT2	
F879 CC	0000		LDD	#0	
F87C DD	09		STD	NOVADD	USE 0 FOR ADDRESS
F87E 86	08		LDA	#STATI	
F880 97	0D		STA	STATUS	INIT STATUS
F882 86	40		LDA	#STAT1I	
F884 97	0E		STA	STATUS+1	INIT STATUS + 1
F886 CC	FE70		LDD	#\$-400	
F889 DD	0B		STD	NOVWC	USE \$400 FOR WORD COUNT
F88B 7E	F91E		JMP	READR	GO READ IN A RECORD

* DISPATCH TABLE FOR COMMANDS

F88E	F91E	DISPA	FDB	READR	000
F890	F8C7		FDB	REW	001
F892	F89E		FDB	ILLEG	010 (OFF LINE- NOT USED)
F894	F8FD		FDB	SPACEF	011
F896	F90C		FDB	SPACER	100
F898	FB8D		FDB	WRITE	101
F89A	FD8E		FDB	WRITFM	110
F89C	FDA8		FDB	ERASE	111
	0030	COMWF	EQU	\$30	COMMAND CODE FOR WRITE FMK
	0008	COMRW	EQU	\$08	COMMAND CODE FOR REWIND

* ILLEGAL COMMAND- SET 'ILLEG' STATUS BIT & RETURN

F89E 96	0D	ILLEG	LDA	STATUS	
F8A0 8A	10		ORA	#\$10	SET ILLEG: error
F8A2 97	0D		STA	STATUS	BIT 4 OF UPPER WORD

* END OF COMMAND EXECUTION

* SET UP DIA STATUS, SET 'DONE' TO NOVA

F8A4 B6	D001	ECOMM	LDA	ZPORTA	STOP TAPE MOTION
F8A7 84	FC		ANDA	#\$FC	
F8A9 B7	D001		STA	ZPORTA	
F8AC B6	C009	EWTNB	LDA	ZR240	WAIT FOR DRIVE NOT BUSY
F8AF 85	02		BITA	#\$02	BEFORE ALLOWING NEXT CMD
F8B1 26	F9		BNE	EWTNB	
F8B3 7F	D001		CLR	ZPORTA	RESET WEN IF IT WAS SET
F8B6 86	03		LDA	#ZREG1	RESET THE USRT
F8B8 B7	D800		STA	ZSYNCO	(CTRL REG 1)
F8BB BD	FE11		JSR	SHOW	SETS UP DIA & DIB
F8BE B7	C800		STA	ZDONE	SET DONE TO THE NOVA
F8C1 7E	F819		JMP	MAIN	THEN STAY IN MAIN LOOP

*
*

* ROUTINE TO REWIND

* NOTE: THERE IS A DELAY BEFORE THE NOVA SEES THE

* 'REWINDING' BIT IN THE DIA STATUS WORD


```

* THIS ROUTINE RETURNS BEFORE THE REWIND IS FINISHED
  FOR TESTING, ONLY
  SO THIS CAN BE CALLED FROM DEBUG
  START MOTION
  NOW SET TRACK 1

  SAVE IN MEMORY IMAGE

  WAIT TILL MOTION STOPS
  BEFORE EXECUTING NEXT CMD
  LOOK FOR BUSY LINE DOWN
  AFTER BOOT, BUSY IS NOT CLEARED.
  SO LOOK AT NON-LATCHED BUSY.
  IF NOT SET, GO TO MAIN LOOP FOR
  NEXT CMD. ELSE, IF LAST CMD WAS
  RWND, WAIT FOR BSY DOWN OR NEW CMD
  NEW CMD, NOT REWIND.
  WAIT BEFORE EXECUTING NEXT.

F8C4 BD  FDC9      *
F8C7 BD  F8F0      *
F8CA 96  0F        *
F8CC 84  FC        *
F8CE 97  0F        *
F8D0 B7  C008      *
F8D3 B6  C009      *
F8D6 85  02        *
F8D8 26  F9        *
F8DA B6  D000      *
F8DD 85  40        *
F8DF 1027 FF36     *
F8E3 FC   C004     *
F8E6 1083 0008     *
F8EA 1026 FF2B     *
F8EE 20   EA       *

      JSR  SELU0
      REW  JSR  REWI
      LDA  MPORTB
      ANDA #$FC
      STA  MPORTB
      STA  DPORTB
      LDA  ZR240
      BITA #$2
      BNE  REWW
      WNCM LDA  ZPORTB
      BITA #$40
      LBEQ MAIN
      LDD  ZNAH
      CMPD #COMRW
      LBNE MAIN
      BRA  WNCM

* SUBROUTINE TO INITIATE REWIND MOTION
F8F0 86  20      REWI LDA  #$20      PUT IN REWIND BIT
F8F2 B7  D001    STA  ZPORTA
F8F5 84  00      ANDA  #$00
F8F7 B7  D001    STA  ZPORTA
F8FA 0F  12      CLR  FSEEN
F8FC 39          RTS

      THEN PUT IT DOWN AGAIN
      A PULSE IS ALL THAT IS NEEDED
      CLEAR FILE MARK COUNTER

```

* SPACE FORWARD
 * USES THE READ ROUTINE, BUT HAS THE FOLLOWING DIFF.:
 * DONT STORE DATA
 * DONT TEST LRCC OR PARITY
 * AFTER READING A RECORD, TEST THE RECORD COUNTER,
 * GO AGAIN IF NECESSARY
 * A FILE MARK WILL TERMINATE THE SPACING LOOP

F8FD 86	02	SPACEF LDA	#2	SET 'READSP' FLAG
F8FF 97	19	SPACE STA	READSP	
F901 DC	0B	LDD	NOVWC	GET RECORD COUNT
F903 DD	1A	STD	RECCNT	
F905 CC	0000	LDD	#0	THEN SET WORD COUNT TO 0
F908 DD	0B	STD	NOVWC	THIS KEEPS IT FROM STORING DATA
F90A 20	16	BRA	RXS	THE REST IS IN COMMON WITH

* SPACE REVERSE
 * USES THE READ ROUTINE, AS DOES SPACE FORWARD
 * YOU MAY NOT GET ANY SYNCs IN REVERSE, SO THE
 * ONLY REQUIREMENT IS TO SEE DAD GO UP THEN DOWN.

F90C 86	44	SPACER LDA	#\$44	USE DIFFERENT SYNC CHAR
F90E 97	1D	STA	RSYNC	
F910 86	54	LDA 28240	#\$54	
F912 97	1E	STA 317A#B405	RFMAR	FILE MARK RECOGNIZER
F914 86	40	BNE ILLEG	#\$40	
F916 97	1F	STA	EOTBIT	LOOK FOR BOT, NOT EOT
F918 86	01	LDA	#1	
F91A 97	1C	STA	TAPDIR	SET UP REV DIRECTION
F91C 20	E1	BRA	SPACE	ALSO STORE 1 IN READSP

* READ A RECORD
 * BEFORE STARTING MOTION, LOOK AT EWS (EOT FLAG)
 * IF HIGH HERE, DONT START READING- CHANGE TRACKS
 * IF T1,2, OR 3 NOW, REWIND & START OVER
 * IF ON TRACK 4, RETURN WITH EOT ERROR TO NOVA

F91E 86	00	READR LDA	#0	
F920 97	19	STA	READSP	SET FLAG- WE ARE READING
F922 BD	FE82	RXS JSR	TSTEOT	TEST FOR EOT

* SET UP TO READ THE RECORD

F925 96	1C	LDA	TAPDIR	START SLOW FWD MOTION
F927 B7	D001	STA	ZPORTA	
F92A 96	0F	LDA	MPORTB	SET DMA DIRECTION- TO NOVA
F92C 8A	20	ORA	#\$20	
F92E 97	0F	STA	MPORTB	SAVE IN MEM IMAGE LOC
F930 B7	C008	STA	DPORTB	
F933 8E	0019	LDX	#25	WAIT 25 MSEC
F936 BD	FE74	JSR	WAIT	DONT READ CRAP IN THE GAP
F939 B6	D00D	LDA	ZINT	
F93C B6	D001	LDA	ZPORTA	CLEAR THE LATCH FOR CA1 IN 6520
F93F 86	8B	LDA	#\$88+ZREG1	RESET THE USRT (& DAD LATCH)
F941 B7	D800	STA	ZSYNC0	ALSO SETS CLEAR-SYNC BIT
F944 96	1D	LDA	RSYNC	SET UP SYNC CHAR
F946 B7	D802	STA	ZSYNC1	
F949 0F	10	CLR	PARITY	
F94B 0F	13	CLR	PECNT	PARITY ERROR COUNTER

```

F94D 86 22 LDA #22 INITIALIZE LRCC
F94F 97 11 STA LRCC
F951 0F 18 CLR INTRW SET INTERRUPT RTN TO READ MOD
F953 B6 C008 LDA ZDCHC SET THE DCH COMPLETE FLAG
F956 109E 0B LDY NOVWC KEEP WCNT IN Y
F959 31 3F LEAY -1,Y DECR BY 1 (NEED -WCNT-1)
F95B CE E900 LDU #BUFF START MEM BUFF POINTER
F95E 86 02 LDA #00000010 NOW ENABLE THE USRT RECVR
F960 B7 D800 STA ZSYNC0
F963 86 15 LDA #15 SET FOR 7 BIT WORD, 1BYTE MO
F965 B7 D802 STA ZSYNC1

* NOW LOOK FOR RISING EDGE OF 'DAD' - IS START OF DATA
* WE ARE SEEING DAD COMPLEMENTED IN STATUS REG.
* IN THIS LOOP YOU CAN GET A TIMEOUT IF THERE IS NO DATA
* IN WHICH CASE YOU RETURN WITH BAD TAPE FLAG.
* NOTE- EWS IS CHECKED UNTIL DAD SEEN
* AFTER THAT, JUST READ WITHOUT CHECKING FWS
* TIMEOUT LOOP TAKES 33 CY = 22 USEC

F968 8E 0215 LDX #533 INIT TIMEOUT COUNTER- 3 SEC
F96B 0A 16 R6 DEC FCHAR TEMP COUNTER- COUNT TO 256
F96D 26 23 BNE NOTIMO
F96F 30 1F LEAX -1,X COUNT DOWN, LOOK FOR TIMEOUT
F971 26 1F BNE NOTIMO COMES HERE EVERY 4.3 MS
F973 20 09 BRA DADBAD

* TIMED OUT- SET BAD TAPE & RETURN
ESIG LDA READSP IF SPACING REVERSE, LOSING
CMPA #1 SIGNAL ISNT AN ERROR
BNE DADBAD OTHERWISE IT IS
JMP EREAD
DADBAD LDA STATUS+1 SET BAD TAPE FLAG
ORA #20
STA STATUS+1
LDA #ZREG1 RESET THE USRT AGAIN
STA ZSYNC0
LEAY 1,Y SEND WDCNT TO NOVA
STY ZNCH
JMP ECOMM

* TEST WHETHER DAD* HAS GONE DOWN
NOTIMO LDA ZSYNC0
BITA #4
BEQ DAD1 DAD* WENT DOWN
LDA ZSYNC1 ELSE CLEAR DAD LATCH
BRA R6 AND KEEP LOOKING

* OK, DAD HAS GONE HI- WAIT FOR DUMMY SYNC
DAD1 LDA #25
DAD2 DECA WAIT 90US & TRY DAD AGAIN
BNE DAD2
LDA ZSYNC0
BITA #4
BEQ DAD3 O.K. DAD* STILL HI
LDA ZSYNC1 ELSE RESET THE DAD LATCH
BRA R6 AND TRY AGAIN
DAD3 LDX NOVADD SET UP ADDRESS
RSYN LDA ZSYNC0 TEST DAD ALSO
BITA #4 IF IT GOES DOWN, EXIT
BNE ESIG
LDA ZINT LOOK FOR THE SYNCMATCH PULSE
BITA #1
BEQ RSYN

```



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F9BF 86 31 LDA #31 SET TO 9BIT MODE, 2 BYTE
F9C1 B7 D802 STA ZSYNC1
F9C4 B6 D001 LDA ZPORTA CLEAR THE CA2 INPUT LATCH

* WAIT FOR FIRST CHARACTER
F9C7 B6 D800 READF LDA ZSYNC0 GET STATUS
F9CA 85 04 BITA #4 DID DAD GO DOWN AGAIN
F9CC 26 A7 BNE ESIG YES, BAD TAPE ERROR
F9CE 85 01 BITA #1 IS CHAR (ACTUALLY 2 CHARS) T
F9D0 27 F5 BEQ READF NO

* 2 CHARS ARE AVAILABLE IN USRT
* THE 'E' CHAR- CHAR AFTER THE SYNC (3F)
* THE 'F' CHAR- 22 OR 55

F9D2 B6 D802 LDA ZSYNC1 GET E CHAR
F9D5 97 15 STA ECHAR SAVE IT
F9D7 B6 D800 LDA ZSYNC0 GET STATUS FOR NEXT CHAR
F9DA 85 60 BITA #60 TEST PE, OV
F9DC 27 02 BEQ R7 OK
F9DE 97 10 STA PARITY ERROR ON FIRST CHAR, STORE STA
F9E0 B6 D802 R7 LDA ZSYNC1
F9E3 97 16 STA FCHAR STORE FIRST CHAR IN MEM FOR L
F9E5 91 1E CMPA RFMAR IS IT A FILE MARK
F9E7 1027 0187 LBEQ RFMK YES, EXIT HERE
F9EB 86 B1 LDA #ZREG2+$80 ENABLE THE EIE INTERRUPT
F9ED B7 D802 STA ZSYNC1 TO FIRQ
F9F0 1C BF ANDCC #BF ** PUT BF HERE TO ENABLE FIRQ
F9F2 20 0A BRA RLOOP1 THEN GO INTO MAIN READ LOOP

* MAIN DATA READ LOOP
* X HOLDS THE NOVA ADDRESS
* Y HOLDS THE -WORDCOUNT (-1)
* U HOLDS THE ADDRESS IN BUFFER RAM
* READS 2 BYTES, STORES IN 1 WORD IN NOVA
* ALSO STORES IN 256 BYTE CIRCULAR BUFFER IN RAM
* IF PARITY ERROR, AN INTERRUPT OCCURS, FLAG IS SET
* WHEN END OF DATA OCCURS, DAD GOES DOWN, INTERRUPTS.
* IF THERE ARE MANY PARITY ERRORS, THIS LOOP WILL BE TOO
* LONG AND OVERRUNS WILL ALSO OCCUR.
* IF WORD COUNT RUNS OUT BEFORE END OF DATA, THE READ
* CONTINUES BUT DATA ISNT STORED. THE LRCC MUST STILL
* MATCH OVER THE ENTIRE RECORD.
* THERE ARE 3 LOOPS IN THE READ ROUTINE
* LOOP 1-- READ INTO BUFFER UNTIL FULL (OR DAD DOWN)

F9F4 85 04 NOBY1 BITA #4 TEST DAD
F9F6 27 06 BEQ RLOOP1 IF OK

* DAD WENT DOWN IN LOOP 1, HAVENT STARTED TO DMA YET
* SET UP PARAMS, GO DIRECTLY TO LOOP 3 TO DMA IT

F9F8 8E E8FE LDX #BUFF-2 POINTER FOR SENDING
F9FB 7E FAB7 JMP EREAD

* LOOP 1 STARTS HERE
F9FE B6 D800 RLOOP1 LDA ZSYNC0 TEST STATUS
FA01 85 01 BITA #1
FA03 27 EF BEQ NOBY1 NOT READY, TEST DAD
FA05 B6 D802 LDA ZSYNC1 GET FIRST CHAR- WILL INTERRUPT
FA08 F6 D802 LDB ZSYNC1 ON ERROR
FA0B ED C1 STD ,U++ PUT IN RAM
FA0D 98 11 EORA LRCC PUT IN LRCC
FA0F 97 11 STA LRCC
FA11 D8 11 EORB LRCC
FA13 D7 11 STB LRCC

```

FA15 1183 EB40
FA19 26 E3

CMPU #BUFTR
BNE RLOOP1

DO THIS UNTIL BUFFER IS FULL
(OR DAD GOES DOWN)

* LOOP 2-- READ INTO BUFFER, WHILE WRITING OUT OF
* THE SAME LOCATION BEFORE FILLING IT
* FOR SHORT RECORDS, LOOP 2 WILL BE SKIPPED

FA1B CE E900

RLI2 LDU #BUFF

START U AT BUFFER

FA1E BF C002

RLOOP2 STX ZNBH

SET UP NOVA ADDR

FA21 31 21

LEAY 1,Y

TEST NOVA WD COUNT

FA23 27 29

BEQ WCOUT

IF NONE LEFT, DONT DMA

FA25 EC C4

LDD 0,U

OK, SET UP DATA TO DMA

FA27 FD C006

STD ZNDH

FA2A B7 C009

STA ZDCHR

START THE CYCLE

FA2D 30 01

LEAX 1,X

NEXT NOVA ADDR

FA2F B6 D800

READM LDA ZSYNC0

NOW LOOK FOR NEW WD READY

FA32 85 01

BITA #1

FA34 27 77

BEQ NOBYT

NO

FA36 B6 D802

LDA ZSYNC1

YES, GET IT- 1 BYTE AT A TIME

FA39 F6 D802

LDB ZSYNC1

FA3C ED C1

STD ,U++

PUT IT IN THE EMPTY SLOT

FA3E 98 11

EORA LRCC

FA40 97 11

STA LRCC

FA42 D8 11

EORB LRCC

FA44 D7 11

STB LRCC

FA46 1183 EB40

CMPU #BUFTR

FA4A 26 D2

BNE RLOOP2

BUFF NOT FULL

FA4C 20 CD

BRA RLI2

BUFF FULL, RESET IT

FA4E 31 3F

WCOUT LEAY -1,Y

WD COUNT OUT, RESET TO -1

FA50 20 DD

BRA READM

*
* IRQ INTERRUPT HANDLER :
*

SET "BSYSET" IF ECLIPSE HAS SET BUSY

CLEAR LATCHED STATUS BITS IF ECLIPSE HAS SET CLEAR

*

FA52 B6 D00D

HIQ LDA ZINT

READ THE 6522 FLAG REGISTER

FA55 F6 D000

LDB ZPORTB

CLEAR INTERRUPT

FA58 85 10

BITA #10

IS CB1 (BUSY) SET?

FA5A 27 04

BEQ HIQ2

BRANCH IF NOT

FA5C C6 10

LDB #10

FA5E D7 26

STB BSYSET

SET RAM BUST FLAG NON-ZERO

FA60 85 08

HIQ2 BITA #08

IS CB2 (CLEAR) SET?

FA62 27 0E

BEQ HIQ3

BRANCH IF NOT

*

* ECLIPSE HAS SET "CLEAR"

FA64 C6 08

LDB #STAT1

FA66 D7 0D

STB STATUS

SET STATUS BYTES TO "CLEAR"

FA68 F7 C004

STB ZNAH

& PUT THEM IMMEDIATELY TO EC

FA6B C6 41

LDB #STAT1+1

FA6D D7 0E

STB STATUS+1

FA6F F7 C005

STB ZNAL

FA72 85 20

HIQ3 BITA #20

IS IT TIMER #2 TIME-OUT?

FA74 27 16

BEQ HIQX

NO.

FA76 C6 20

LDB #20

YES. DISABLE IT FROM FURTHER

FA78 F7 D00E

STB ZINTE

IRQS

FA7B 32 6C

LEAS 12,S

CLEAN STACK, NOT DOING RTI

FA7D 86 0A

LDA #0A

STOP THE STROBES

FA7F B7 D001

STA ZPORTA

FA82 86 C2

LDA #C2

DISABLE THE XMITTER

FA84 B7 D800

STA ZSYNC0

FA87 1C EF
FA89 7E FD57
FA8C 3B

ANDCC #EF ENABLE IRQ
JMP WL3BAD
HIRQX RTI

*

* READ-CHAR INTERRUPT ROUTINE

* FIRQ INTERRUPTS TO HERE ON 'EIE'- PARITY ERR,

* OVERRUN, DAD FALLING EDGE, OR (SHOULDN'T HAPPEN) CTS,

* XMT UNDERFLOW

* ON PE OR OV, JUST SET FLAG, RETURN TO LOOP. THIS WILL

* INCREASE THE TIMING OF THE LOOP SO THAT IT WILL FALL

* BEHIND, AND THEN GIVE OV ERRORS ALSO.

* ON DAD TRANSITION, THIS IS THE END OF THE RECORD.

FA8D B6 D800
FA90 85 04
FA92 26 12

FIRQR LDA ZSYNC0 GET STATUS

BITA #4 IS DAD DOWN

BNE ENDREC YES, END RECORD

* PE OR OV, 'OR' THE STATUS WORD INTO 'PARITY' IN RAM

* NOTE: IN ORDER TO CLEAR THE INTERRUPT, WE HAVE TO

* READ THE DATA CHARACTER. THIS WILL SCREW UP THE MAIN

* LOOP, WHICH IS ALSO EXPECTING TO READ IT. THAT'S

* WHAT YOU GET FOR HAVING PARITY ERRORS.

* NOTE 2- IGNORE BAD PARITY AFTER THE WORD COUNT

* HAS RUN OUT- SO YOU DON'T CHECK THE GARP AT END

FA94 108C FFFF
FA98 27 06
FA9A 9A 10
FA9C 97 10
FA9E 0C 13
FAA0 B6 D802
FAA3 35 06
FAA5 3B

CMPY #-1

BEQ FR2

NO WORD COUNT, DON'T TEST

ORA PARITY

STA PARITY

INC PECNT

COUNT BYTES WITH ERRORS

FR2 LDA ZSYNC1

READ THE DATA CHAR

FR3 PULS D

RETURN TO MAIN LOOP

RTI

* END OF RECORD

* DISABLE THE EIE INTERRUPT SO YOU CAN RETURN TO

* THE MAIN LOOP. IT WILL EXIT TO 'NOBYT' AT THE

* NEXT OPPORTUNITY.

FAA6 86 31
FAA8 B7 D802
FAAB 20 F6

ENDREC LDA #ZREG2

STA ZSYNC1

BRA FR3

RETURN FROM INTERRUPT

* TEST FOR EXIT FROM READ LOOP

FAAD 85 04
FAAF 1027 FF7C
FAB3 9F 09
FAB5 1F 31

NOBYT BITA #4

TEST DAD BIT

LBEQ READM

IF DAD IS HI, KEEP LOOPING

STX NOVADD

UPDATE NOVA ADDR

TFR U,X

LOAD POINTER FOR COPYING OUT

* OK, DAD WENT DOWN- END THE READ ROUTINE

FAB7 1A 40
FAB9 86 03
FABB B7 D800

EREAD ORCC #40

MASK OUT THE INTERRUPT

LDA #ZREG1

RESET THE USRT

STA ZSYNC0

* BRANCH HERE BETWEEN READING AND SPACING

FABE 96 19
FAC0 26 06
FAC2 4F
FAC3 B7 D001
FAC6 20 19

LDA READSP

BNE ESPAC

CLRA

ON END OF READ,

STA ZPORTA

STOP MOTION

BRA READ2

* SPACING- TEST RECORD COUNT. READ ANOTHER IF NOT 0.

* TEST FOR EOT, ETC ON EVERY RECORD

FAC8 9E 1A
FACA 30 01
FACC 9F 1A
FACE 1026 FE50

ESPAC LDX RECCNT

LEAX 1,X

STX RECCNT

LBNE RXS

READ ANOTHER



FAD2 96 1C
 FAD4 81 01
 FAD6 26 06
 FAD8 8E 000A
 FADB BD FE74
 FADE 16 FDC3
 FAE1 0000

LDA TAPDIR ON LAST REC OF SPACING:
 CMPA #1
 BNE EREADX ON SPACE REV, KEEP
 LDX #10 GOING BACK AN EXTRA
 JSR WAIT 10 MS.
 EREADX LBRA ECOMM ELSE DONE
 READ2 RMB 0

* READ-- TEST FOR ERRORS
 * HERE, U POINTS TO LAST CHAR STORED (IN RAM) +1
 * U IS ALWAYS EVEN HERE BECAUSE BUFF STARTS AT EVEN NO
 * BACK UP, REMOVING CHARS FROM LRCC, UNTIL YOU SEE
 * THE \$22 RECORD TERMINATOR (REMOVE IT ALSO)
 * AT THAT POINT, THE LRCC SHOULD BE 0
 * HERE, NOVADD CT (LAST NOVA ADDR)+1
 * X POINTS TO LAST WD SENT TO NOVA, INCR FIRST
 * U POINTS TO (LAST WD STORED IN RAM)+2
 * FIRST MOVE U BACKWARDS TO STRIP POSTAMBLE
 * THEN SEND (FROM X TO U) TO NOVA VIA DMA

FAE1 86 1E
 FAE3 97 20
 FAE5 0A 20
 FAE7 27 2B
 FAE9 33 5F
 FAEB 1183 E8FF
 FAEF 26 03
 FAF1 CE EB3F
 FAF4 A6 C4
 FAF6 98 11
 FAF8 97 11
 FAFA A6 C4
 FAFC 81 22
 FAFE 26 E5
 FB00 33 5F

RSTRIP LDA #30 LIMIT N BYTES
 STA COUNT
 R8 DEC COUNT TEST COUNT, QUIT IF >30
 BEQ R8C
 LEAU -1,U BACKSPACE U BY 1
 CMPU #BUFF-1 DID IT GO OVER THE BOTTOM
 BNE R8A
 LDU #BUFTR-1 YES, WRAP
 R8A LDA 0,U GET CHAR
 EORA LRCC REMOVE FROM LRCC
 STA LRCC
 LDA 0,U NOW, WAS IT 22
 CMPA #\$22
 BNE R8 NO, KEEP GOING
 LEAU -1,U POINT TO LRCC (IN EVEN BYTE)

* TEST FOR ODD CHAR
 * IF YES, THE LRCC WILL BE IN ODD BYTE (OF SAME WD)
 * IN BOTH CASES, STRIP THE WD CONTAINIG 22, WILL
 * LEAVE YOU WITH 1 MORE WD IF IT IS ODD CHAR

FB02 1F 30
 FB04 C5 01
 FB06 27 08
 FB08 33 41
 FB0A 96 0E
 FB0C 8A 02
 FB0E 97 0E
 FB10 96 11
 FB12 27 06
 FB14 96 0D
 FB16 8A 04
 FB18 97 0D
 FB1A DF 24

TFR U,D
 BITB #1 TEST LSB
 BEQ R8B IF EVEN, SKIP
 LEAU 1,U IF ODD, INCR U TO NEXT WD
 LDA STATUS+1 SET ODD CHAR BIT
 ORA #\$2
 STA STATUS+1
 R8B LDA LRCC NOW TEST LRCC, SHOULD BE
 BEQ R8D 0 HERE
 R8C LDA STATUS LRCC ERROR
 ORA #\$4 SET PARITY ERR BIT
 STA STATUS
 R8D STU TEMPY

* READ LOOP 3-- DMA THE REST OF THE BUFFER INTO THE NOVA
 * TEMPY POINTS TO THE WORD FOLLOWING EOR
 * TRANSFER TO NOVA UNTIL WCNT RUNS OUT OR EOR REACHED
 * INCR NOVA ADDR ON EACH WD SENT
 * THEN RETURN FINAL WCNT, ADDR TO NOVA
 * NOTE, CURRENTLY, NEITHER READ NOR WRITE CONTAINS
 * A TEST FOR DMA OVERRUN TO THE NOVA *****

FB1C 108C FFFF
 FB20 27 2F

RLOOP3 CMPLY #-1 IS WCNT OUT
 BEQ R3DONE YES, QUIT

FB22 30	02		LEAX	2,X	LOOK AT NEXT WD IN BUFFER
FB24 8C	EB40		CMPX	#BUFTR	IS THERE ONE
FB27 26	03		BNE	R3A	
FB29 8E	E900		LDX	#BUFF	WRAP AROUND IF AT TOP
FB2C 9C	24	R3A	CMPX	TEMPY	
FB2E 27	21		BEQ	R3DONE	IF EOR
		* OK, DO A DMA	CYCLE		
FB30 B6	D000		LDA	ZPORTB	MAKE SURE DMA IS READY HERE
FB33 2B	06		BMI	R3M	IF OK
FB35 96	0D		LDA	STATUS	IF NOT, SET DMA-LATE BIT
FB37 8A	40		ORA	#\$40	
FB39 97	0D		STA	STATUS	
FB3B 31	21	R3M	LEAY	1,Y	INCR WCNT
FB3D DC	09		LDD	NOVADD	GET NOVA ADDR
FB3F FD	C002		STD	ZNBH	
FB42 C3	0001		ADDD	#1	INCREMENT IT
FB45 DD	09		STD	NOVADD	
FB47 EC	84		LDD	0,X	GET DATA
FB49 FD	C006		STD	ZNDH	
FB4C B7	C009		STA	ZDCHR	START CYCLE
FB4F 20	CB		BRA	RLOOP3	
FB51 31	21	R3DONE	LEAY	1,Y	SEND WDCNT BACK TO NOVA
FB53 10BF	C000		STY	ZNCH	
FB57 96	10	RPTEST	LDA	PARITY	TEST PARITY BIT
FB59 85	40		BITA	#\$40	
FB5B 27	06		BEQ	R9	IF OK
FB5D 96	0D	RPERR	LDA	STATUS	IF EITHER PARITY OR LRCC, SET
FB5F 8A	04		ORA	#\$4	THE 'PARITY' ERR BIT
FB61 97	0D		STA	STATUS	
FB63 96	10	R9	LDA	PARITY	NOW TEST FOR OVERRUN
FB65 85	20		BITA	#\$20	FROM THE USRT
FB67 27	06		BEQ	R10	IF NO
FB69 96	0D		LDA	STATUS	IF YES, SET THE DATA LATE BIT
FB6B 8A	40		ORA	#\$40	TO NOVA
FB6D 97	0D		STA	STATUS	
FB6F 7E	F8A4	R10	JMP	ECOMM	

* FILE MARK SEEN

* SET THE STATUS BIT, EXIT

FB72 31	21	RFMK	LEAY	1,Y	RETURN WCNT OF 0 TO NOVA
FB74 10BF	C000		STY	ZNCH	
FB78 96	0D		LDA	STATUS	SET STATUS BIT
FB7A 8A	01		ORA	#\$1	
FB7C 97	0D		STA	STATUS	
FB7E 96	1C		LDA	TAPDIR	WHICH DIRECTION
FB80 81	02		CMPA	#2	MAINTAIN THE FSEEN COUNTER
FB82 26	04		BNE	RFMK2	
FB84 0C	12		INC	FSEEN	FWD
FB86 20	02		BRA	RFMK3	
FB88 0A	12	RFMK2	DEC	FSEEN	REV
FB8A 7E	FB57	RFMK3	JMP	RPTEST	TERMINATES EITHER SPACE OR REAL

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* WRITE ROUTINE
FB8D 86 04 WRITE LDA #4 PREAMBLE WDCNT
FB8F 97 20 WRIT STA COUNT
FB91 86 06 LDA #6 POSTAMBLE WDCNT
FB93 97 27 STA PSCNT
FB95 B6 C009 LDA ZR240 TEST FOR UNPROTECTED
FB98 85 08 BITA #58
FB9A 26 09 BNE WUNP IF OK
FB9C 96 0D UNPERR LDA STATUS SET ERROR BIT ONLY
FB9E 8A 80 ORA #580
FBA0 97 0D STA STATUS
FBA2 7E F8A4 WUNP JMP ECOMM
FBA5 BD FE82 WUNP JSR TSTEOT TEST FOR EOT BEFORE MOVING TAPE
FBA8 86 0A LDA #50A OK, START MOTION, WITH WEN
FBAA B7 D001 STA ZPORTA
FBAD 96 0F LDA MPORTB SET DMA DIRECTION
FBAF 84 DF ANDA #5FF-520 0=OUT OF NOVA
FBB1 97 0F STA MPORTB
FBB3 B7 C008 STA DPORTB
FBB6 B6 C008 LDA ZDCHC SET THE DCH COMPLETE FLAG
FBB9 DE 09 LDU NOVADD GET NOVA ADDRESS INTO U
FBBB FF C002 STU ZNBH SET UP FOR INITIAL DMA CYCLE
FBBE 96 14 LDA LCOMM LOOK AT COMMAND CODE
FBC0 81 30 CMPA #COMWF
FBC2 27 03 BEQ WIO IF WRT FILE MK, DONT DO DMA
FBC4 B7 C009 STA ZDCHR START DMA CYCLE
FBC7 33 41 WIO LEAU 1,U NEXT ADDR
FBC9 86 22 LDA #522
FBCB 97 11 STA LRCC START THE LRCC
FBCD 86 8B LDA #588+ZREG1 RESET USRT
FBCF B7 D800 STA ZSYNC0
FBD2 86 0D LDA #50D SET UP SYNC CHAR FOR READ
FBD4 B7 D802 STA ZSYNC1 AFTER WRITE
FBD7 86 01 LDA #1
FBD9 97 18 STA INTRW INTERRUPT ROUTINE WILL HANDLE
FBDB 97 21 STA WRITOK WRITE-OK FLAG STARTS NONZERO
* TIME OUT THE IRG- 35 MS NORMAL, 1 SEC IF BOT
FBDD BD FE11 WIO JSR SHOW KEEP SHOWING STATUS
FBE0 B6 C009 LDA ZR240 LOOK AT LPS TO TEST BOT
FBE3 85 40 BITA #540
FBE5 26 F6 BNE WIO0 STAY HERE TILL LPS GOES DOWN
FBE7 8E 0023 LDX #35 THEN TIME OUT NORMAL GAP
FBEA BD FE74 WIO JSR WAIT
FBED BD FE11 JSR SHOW SHOW STATUS W/O BOT BIT
* SET UP POSTAMBLE
* IT ALL GOES IN RAM BECAUSE OF LRCC
FBF0 CC 0022 LDD #522
FBF3 FD E860 STD POSTAM LRCC, RECORD TYPE
FBF6 CC FF04 LDD #5FF04 SYNC & SINGLE BIT FOLLOWING
FBF9 FD E862 STD POSTAM+2
FBFC CC 0000 LDD #0
FBFF FD E864 STD POSTAM+4
FC02 FD E866 STD POSTAM+6
FC05 FD E868 STD POSTAM+8
FC08 FD E86A STD POSTAM+10

```

* SET UP BUFFER POINTERS

* YOU WANT TO CALCULATE THE STARTING ADDRESS SO

* THAT THE LAST WORD OF DATA WILL BE IN THE TOP OF

* THE BUFFER. DIVIDE WDCNT BY 256 SO THE QUOTIENT IS

* THE NO OF PAGES OF 256W, AND THE REMAINDER (NEG.)
 * IS WHERE YOU START THE FIRST DATA WORD.
 * NOTE- ONE MORE WORD IS READ THAN IS WRITTEN-
 * THE FF AND 22 IS WRITTEN AS PART OF THE PREAMBLE
 * BUT IS CHECKED ALONG WITH THE DATA.

FC0B DC	0B		LDD	NOVWC	
FC0D 43			COMA		NEGATE THE WDCNT
FC0E 53			COMB		
FC0F C3	0001		ADDD	#1	HAVE POSITIVE WDCNT
FC12 5D			TSTB		HOW MANY WRITE PAGES
FC13 27	01		BEQ	WI2	IF REMAINDER IS .NE. 0,
FC15 4C			INCA		THERE IS 1 MORE PAGE IN
FC16 97	22	WI2	STA	NPAGW	N PAGES TO WRITE
FC18 97	23		STA	NPAGR	
FC1A 50			NEGB		LOW ORDER ADDR OF FIRST
FC1B 8E	E900		LDX	#\$E900	NEED TO GET E900+(LOW ADDR)*2
FC1E 3A			ABX		
FC1F 3A			ABX		
FC20 9F	24		STX	TEMPY	
FC22 30	1E		LEAX	-2,X	GET READ ADDR- 1 WD EARLIER
FC24 8C	E8FE		CMPL	#BUFF-2	DID IT WRAP BELOW BOTTOM?
FC27 26	05		BNE	WI3	
FC29 0C	23		INC	NPAGR	IF YES, ONE MORE PAGE TO READ
FC2B 8E	EAFE		LDX	#BUFF+\$1FE	FIX UP BUFF ADDR
FC2E CC	FF22	WI3	LDD	#\$FF22	SET UP THE FIRST WD IN THE BUFF
FC31 ED	84		STD	0,X	READ ADDR STAYS IN X
FC33 B6	D000	WI4	LDA	ZPORTB	NOW, IS FIRST DMA CYCLE DONE
FC36 2A	FB		BPL	WI4	IT BETTER BE
			* SET UP USRT-	ENABLE BOTH XMTR AND RCVR	
FC38 86	03		LDA	#ZREG1	
FC3A B7	D800		STA	ZSYNC0	POINT TO CTRL2 REGISTER
FC3D 86	B1		LDA	#\$B1	SET WD LENGTH, EIE INTRR
FC3F B7	D802		STA	ZSYNC1	
FC42 86	C0		LDA	#\$C0	ENABLE XMT & RCV, POINT TO DA
FC44 B7	D800		STA	ZSYNC0	
FC47 CC	0000		LDD	#0	LOAD 00 FOR DATA OUT
FC4A FD	D802		STD	ZSYNC1	
FC4D 86	1A		LDA	#\$1A	FINALLY, ENABLE WDE TO DRIVE
FC4F B7	D001		STA	ZPORTA	
FC52 4F			CLRA		
FC53 B7	D00B		STA	T2ACR	SETUP TIMER#2
FC56 86	FF		LDA	#255	ABOUT 43.5MS TIMEOUT
FC58 B7	D009		STA	T2HOC	
FC5B 86	A0		LDA	#\$A0	ENABLE TIMER#2 TO IRQ
FC5D B7	D00E		STA	ZINTE	
			* WRITE LOOP 1-- WRITE PREAMBLE		
			* NO READ DATA HERE, IT ISNT READY YET		
FC60 108E	FD84		LDY	#PREAM	POINTER
FC64 B6	D800	WLOOP1	LDA	ZSYNC0	GET USRT STATUS
FC67 85	02		BITA	#\$2	IS TDRA READY
FC69 27	F9		BEQ	WLOOP1	
FC6B EC	A1		LDD	,Y++	YES, GET 2 BYTES
FC6D B7	D802		STA	ZSYNC1	
FC70 F7	D802		STB	ZSYNC1	WRITE THEM SEPARATELY
FC73 0A	20		DEC	COUNT	COUNT 4 PAIRS
FC75 26	ED		BNE	WLOOP1	
FC77 96	14		LDA	LCOMM	WHAT IS COMMAND
FC79 81	30		CMPL	#COMWF	
FC7B 1027	0119		LBEQ	WRITFN	BRANCH HERE

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FC7F 1C BF ANDCC # $BF ENABLE HARD TAPE ERRS TO FIRQ
FC81 B6 D800 WL1A LDA ZSYNCO WAIT FOR READY AGAIN
FC84 85 02 BITA # $2
FC86 27 F9 BEQ WL1A
FC88 86 22 LDA # $22 WRITE FIRST CHAR OF 22
FC8A B7 D802 STA ZSYNCO (JUST WRITE 1 CHAR, IS OK)
FC8D 109E 24 LDY TEMPY SET UP FOR MAIN LOOP

* WRITE LOOP 2- MAIN WRITE LOOP
* GETS DATA VIA DMA, WRITES OUT
* ALSO READS AND CHECKS DATA IF ANY (YET)
* Y: POINTER TO STORE XMT DATA INTO RAM
* X: POINTER TO READ RCV DATA FROM RAM
* U: NOVA ADDR, INIT TO SECOND WORD
* FIRST WD IS ALREADY IN THE REGISTER
* LRCC: CUMULATIVE LRCC

FC90 86 FF WLP2S LDA #255 43.5MS TIMEOUT
FC92 B7 D009 STA T2HOC
FC95 B6 D800 WLOOP2 LDA ZSYNCO (5) GET USRT STATUS
FC98 85 02 BITA # $2 2 IS XMT READY
FC9A 26 06 BNE WL2T 3 YES
FC9C 85 01 BITA # $1 IF NOT XMT, IS RCVR READY
FC9E 26 38 BNE WL2R YES
FCA0 20 F3 BRA WLOOP2

* XMIT SIDE- SEND OUT 2 BYTES
WL2T LDD ZNDH 6 GET THE WORD
FCA2 FC C006 STU ZNBH 6 SET UP NEW NOVA ADDR
FCA5 FF C002 STA ZDCHR 5 STRT NEW DMA CYCLE
FCA8 B7 C009 LEAU 1,U 5 INCREMENT IT
FCAB 33 41 STA ZSYNCO 5 SEND WORD TO USRT
FCAD B7 D802 STB ZSYNCO 5
FCB0 F7 D802 STD ,Y++ 11 PUT IN RAM
FCB3 ED A1 EORA LRCC 4 PUT BOTH BYTES INTO LRCC
FCB5 98 11 STA LRCC 4
FCB7 97 11 EORB LRCC 4
FCB9 D8 11 STB LRCC 4
FCBB D7 11 TESTW CMPLY #BUFTOP 5 DID RAM ADDR RUN OVER
FCBD 108C EB00 BNE WLOOPR 3 NO, QUIT
FCC1 26 08 DEC NPAGW COUNT PAGES
FCC3 0A 22 BEQ WLOOPE NO MORE- END OF DATA
FCC5 27 31 LDY #BUFF RAM ADDR RAN OVER, RESET IT
FCC7 108E E900

* RECEIVE SIDE- READ 2 BYTES WHEN READY, CHECK
FCCB B6 D800 WLOOPR LDA ZSYNCO 5 GET STATUS
FCCE 85 01 BITA # $1 2 TEST RCV FIRST
FCD0 26 06 BNE WL2R 3 YES
FCD2 85 02 BITA # $2 IF NO, IS XMTR READY
FCD4 26 CC BNE WL2T
FCD6 20 F3 BRA WLOOPR
FCD8 B6 D802 WL2R LDA ZSYNCO 5 GET 2 CHARS FRO USRT
FCDB F6 D802 LDB ZSYNCO 5
FCDE 10A3 81 CMPD ,X++ 13 TEST AGAINST DATA
FCE1 27 02 BEQ WL2RR 3 IF OK
FCE3 0F 21 CLR WRITOK IF BAD, CLEAR FLAG
FCE5 8C EB00 WL2RR CMPX #BUFTOP 4 IS ADDR OVER THE TOP
FCE8 26 A6 BNE WLP2S 3 NO, OK
FCEA 8E E900 LDX #BUFF YES, RESET IT
FCED 0A 23 DEC NPAGR COUNT READ PAGES
FCEF 20 9F BRA WLP2S

* SET UP FOR LOOP 3
FCF1 86 FF WIL3 LDA #255 TIMEOUT 43.5MS

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FCF3 B7 D009 STA T2HOC
FCF6 20 09 BRA WLOOP3
FCF8 96 11 WLOOPE LDA LRCC PUT LRCC IN RAM
FCFA B7 E860 STA POSTAM
FCFD 108E E860 LDY #POSTAM START POINTER

* WRITE LOOP 3- WRITE POSTAMBLE
* READ AND CHECK DATA FROM READ SIDE ALSO
* (IT MAY NOT HAVE STARTED YET)
* IF READ DOESNT START WITHIN 43.5MS, OR IF THERE IS
* 43.5 MS GAP IN READ DATA, STOP, CALL IT PARITY ERROR

FD01 B6 D800 WLOOP3 LDA ZSYNC0 IS XMTR READY
FD04 85 01 BITA #$1 TEST RCVR FIRST
FD06 26 24 BNE WL3R
FD08 85 02 BITA #$2 THEN TEST XMTR
FD0A 27 F5 BEQ WLOOP3

* XMIT SIDE- SEND OUT A WORD
* THIS WONT BE EXECUTED AFTER LAST WORD SENT
FD0C 96 27 WL3T LDA PSCNT IS POISTAMBLE DONE
FD0E 27 0C BEQ WL3E YES, SHUT DOWN XMTR HERE
FD10 EC A1 LDD ,Y++ NO, GET WD, SEND OUT
FD12 B7 D802 STA ZSYNC1
FD15 F7 D802 STB ZSYNC1
FD18 0A 27 DEC PSCNT
FD1A 20 E5 BRA WLOOP3

* COUNT RAN OUT, TURN OFF WDE, DISABLE XMTR
* NOTE- HERE, THERE ARE 2 BYTES OF 0 STILL TO
* BE SENT OUT, TO HELL WITHEM
FD1C 86 0A WL3E LDA #$0A THIS WILL STOP THE STROBES
FD1E B7 D001 STA ZPORTA
FD21 86 C2 LDA #$C2 DISABLE THE XMTR
FD23 B7 D800 STA ZSYNC0
FD26 108E E860 LDY #POSTAM RESET Y, IN CASE MORE SENT
FD2A 20 D5 BRA WLOOP3 STAY IN LOOP TILL READ DONE

* READ SIDE
FD2C B6 D802 WL3R LDA ZSYNC1 GET 2 BYTES, TEST
FD2F F6 D802 LDB ZSYNC1
FD32 10A3 81 CMPD ,X++
FD35 27 02 BEQ WL3RR THIS IS SAME AS IN WLOOP2
FD37 0F 21 CLR WRITOK
FD39 8C EB00 WL3RR CMPX #BUFTOP
FD3C 26 B3 BNE WIL3 AFTER READ, RESTART TIMEOUT
FD3E 8E E900 LDX #BUFF
FD41 0A 23 DEC NPAGR COUNT READ PAGES
FD43 26 AC BNE WIL3

* READ ROUTINE HAS SEEN ALL THE DATA- STOP HERE
FD45 1A 40 WBENT ORCC #$40 DISABLE FIRQ
FD47 86 20 LDA #$20 DISABLE TIMER#2 FROM IRQ
FD49 B7 D00E STA ZINTE
FD4C B7 D008 STA T2LOL
FD4F 4F CLRA
FD50 B7 D009 STA T2HOC FORCE A SHORT TIMEOUT
FD53 96 21 LDA WRITOK ON TIMER#2 SO FLAG CAN BE CLRD
FD55 26 06 BNE WL3K WAS R.A.W. OK?
FD57 96 0D WL3BAD LDA STATUS NO, CALL IT A PARITY ERROR
FD59 8A 04 ORA #$4
FD5B 97 0D STA STATUS
FD5D 86 08 WL3K LDA #$8 STOP MOTION, KEEP WEN
FD5F B7 D001 STA ZPORTA
FD62 DF 09 STU NOVADD SEND FINAL DATA TO NOVA

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FD64 0F	0B	CLR	NOVWC	FINAL WDCNT IS 0
FD66 0F	0C	CLR	NOVWC+1	
FD68 96	14	LDA	LCOMM	TEST COMMAND
FD6A 81	30	CMPLA	#COMWF	IS IT WRITE FILE MARK?
FD6C 26	10	BNE	WEXIT	BRANCH AROUND IF NOT
FD6E 96	0D	LDA	STATUS	IF WFM, SET EOF BIT
FD70 85	04	BITA	#\$4	UNLESS THERE WAS AN ERROR
FD72 26	0A	BNE	WEXIT	THERE WAS!
FD74 D6	0E	LDB	STATUS+1	
FD76 C5	20	BITB	#\$20	
FD78 26	04	BNE	WEXIT	THERE WAS!
FD7A 8A	01	ORA	#1	
FD7C 97	0D	STA	STATUS	
FD7E B6	D008	WEXIT LDA	T2LOL	CLEAR TIMER#2 FLAG
FD81 7E	F8A4	JMP	ECOMM	DONE

* THIS IS YOUR BASIC PREAMBLE

FD84	00	PREAM	FCB	0	
FD85	00		FCB	0	
FD86	00		FCB	0	
FD87	00		FCB	0	
FD88	00		FCB	0	
FD89	C0		FCB	\$C0	
FD8A	0D		FCB	\$0D	
FD8B	FF		FCB	\$FF	
FD8C	55	FNKE	FCB	\$55	EXTRA FOR WRT FILE MARK
FD8D	FF		FCB	\$FF	

* WRITE FILE MARK ROUTINE
 * THIS ROUTINE USES CODE IN THE WRITE ROUTINE
 * DIFFERENCES ARE:
 * WRITE 2 MORE BYTES IN PREAMBLE (IS ENTIRE FMK)
 * NO DMA FROM NOVA
 * USE WDCNT OF 0- READS + CHECKS 1 WD
 * FIRST WD IS FF55 NOT FF22
 * BRANCH OUT AFTER WRITING PREAMBLE, GO TO POSTAMBLE
 * START AT POSTAMBLE+3, WRITE 5 WDS NOT 6

FD8E CC	0000	WRITFM	LDD	#0	
FD91 DD	0B		STD	NOVWC	WORD COUNT
FD93 86	05		LDA	#5	
FD95 7E	FB8F		JMP	WRIT	SET PREAMBLE WDCNT AND GO
FD98 CC	FF55	* PICK UP HERE	AFTER PREAMBLE WRITTEN		
FD9B ED	84	WRITFN	LDD	#\$FF55	CHANGE WD IN RD BUFFER
FD9D 108E	E863		STD	0,X	
FDA1 86	05		LDY	#POSTAM+3	
FDA3 97	27		LDA	#5	WDCNT FOR WRITING
FDA5 7E	FD01		STA	PSCNT	
			JMP	WLOOP3	

* ERASE ROUTINE

FDA8 B6	C009	ERASE	LDA	ZR240	TEST FOR UNPROTECTED
FDAB 85	08		BITA	#\$8	
FDAD 1027	FDEB		LBEQ	UNPERR	NO, QIUT
FDB1 BD	FE82		JSR	TSTEOT	TEST FOR EOT
FDB4 86	0A		LDA	#\$0A	START MOTION WITH WEN
FDB6 B7	D001		STA	ZPORTA	
FDB9 B6	C009	EBOT	LDA	ZR240	DONT START TIMING UNTIL
FDBC 85	50		BITA	#\$50	OFF BOT

FDBE 26	F9	BNE	EBOT
FDC0 8E	015E	LDX	#350
FDC3 BD	FE74	JSR	WAIT
FDC6 7E	FD5D	JMP	WL3K

TIME OUT 350 MS

EXIT SAME AS WRITE ROUTINE

* SUBROUTINES

* SELU0-- SUBROUTINE TO INITIALIZE THE ENTIRE SYSTEM

* SELECTS UNIT 0, TRACK 0, INIT THE USRT AND 6522

FDC9 86	BF	SELU0 LDA	#\$BF	ALL OUTPUTS EXC. BIT 6
FDCB B7	D003	STA	ZDIRA	DIRECTION REG FOR PORT A
FDCE 86	00	LDA	#\$0	
FDD0 B7	D002	STA	ZDIRB	PORT B - ALL INPUTS
FDD3 86	51	LDA	#\$51	6522 PERIPH CONTROL REG:
FDD5 B7	D00C	STA	ZCTRL	CB1="BUSY" (FROM ECL)
				INT ON POS EDGE
				CB2="CLEAR" (FROM ECL)
				INT ON POS EDGE
				CA1=???
				NO INT. FLAG ON NEG EDGE
				CA2=SYNCH MATCH
				NO INT. FLAG ON POS EDGE

FDD8 86	98	LDA	#\$98	
FDDA B7	D00E	STA	ZINTE	
FDDD 86	80	LDA	#\$80	SET UP PORT A
FDDF B7	D001	STA	ZPORTA	SELECT GATE ON - OTHERS OFF
FDE2 4F		CLRA		
FDE3 97	0F	STA	MPORTB	
FDE5 B7	C008	STA	DPORTB	SELECT TRACK 1, DRV 0, DATA CH
FDE8 B7	D001	STA	ZPORTA	GATE THE UNIT SELECT ON
FDEB 97	26	STA	BSYSET	INITIALIZE "BUSY" TO 0

* INITIALIZE THE USRT REGISTERS

* THERE ARE 4 OUTPUT REGISTERS ON CODE 1- TO SELECT WHICH

* ONE IS USED, SET THE 'AC' BITS WHEN WRITING CTRL REG 0

	0003	ZREG1 EQU	%11	NORMAL CONTENTS OF CTRL REG
	0031	ZREG2 EQU	%0011000	NORMAL CONTENTS OF CTRL REG 2
FDED 86	83	LDA	#\$80+ZREG1	POINT TO SYNC CHAR REG
FDEF B7	D800	STA	ZSYNC0	ALSO DISABLE INTRR, RESET T & R
FDF2 86	70	LDA	#\$70	SET SYNC CHAR
FDF4 B7	D802	STA	ZSYNC1	
FDF7 86	43	LDA	#\$40+ZREG1	POINT TO CTRL3 REGISTER
FDF9 B7	D800	STA	ZSYNC0	
FDFC 86	02	LDA	#\$0010	SET FOR 1 SYNC, INTERNAL SYNC M
FDFE B7	D802	STA	ZSYNC1	
FE01 86	03	LDA	#\$0+ZREG	POINT TO CTRL 2 REG
FE03 B7	D800	STA	ZSYNC0	
FE06 86	31	LDA	#ZREG2	SET FOR NO EIE, NO TX SYNC, 8BI
FE08 B7	D802	STA	ZSYNC1	EVEN PAR, 2BYTE XFR, DTR USED
FE0B 39		RTS		DONE

* SHOW-- SUBROUTINE TO COMPUTE THE DIA STATUS WORD

* CALL THIS SUBROUTINE REPEATEDLY TO MAINTAIN THE STATUS

* SO IT WILL BE VALID ANY TIME NOVA LOOKS AT IT

* ENTER AT SHOWB WHEN IDLE- READS ADDR FROM DOB REGISTER

FE0C FC	C002	SHOWB LDD	ZNBH	COPY DOB CONTENTS TO MEMORY
FE0F DD	09	STD	NOVADD	

*

FE11 B6	C005	SHOW LDA	ZNAL	GET COMMAND REG
FE14 84	38	ANDA	#\$38	MASK COMMAND BITS
FE16 81	10	CMPA	#\$10	CHECK FOR ILLEGAL




```

FE18 26 0E BNE SH0 NOT - DONT ECHO
FE1A FC C002 LDD ZNBH YES ECHO B AND C REGISTER
FE1D FD C002 STD ZNBH
FE20 FC C000 LDD ZNCH ECHO C REGISTER
FE23 FD C000 STD ZNCH
FE26 20 05 BRA SHA
FE28 DC 09 SH0 LDD NOVADD COPY MEM ADDRESS TO DIB REGISTER
FE2A FD C002 STD ZNBH

* BUILD THE STATUS WORD- RIGHT HALF FIRST
* GET NON LATCHED BITS FROM THE INPUTS FROM DRIVE
* GET LATCHED BITS FROM 'STATUS' LATCH
* THIS ROUTINE SETS UP RDY, BOT, WRT LOCK, AND REW.

FE2D D6 0E SHA LDB STATUS+1 GET LATCHED BITS (LOW HALF)
FE2F C4 62 ANDB #LACHL ZAP OUT OTHERS
FE31 B6 C009 LDA ZR240 READ THE INPUTS
FE34 85 80 BITA #$80 TEST RDY
FE36 27 17 BEQ SH2
FE38 CA 01 ORB #$1 IF ON, ADD BIT 0 TO REG. B
FE3A 85 40 BITA #$40 IF READY TEST BOT BIT
FE3C 27 08 BEQ SH1
FE3E 96 0F LDA MPORTB MUST ALSO BE TRACK 0
FE40 85 03 BITA #3 TO GET BOT INDICATION
FE42 26 02 BNE SH1 IF NOT T.0
FE44 CA 80 ORB #$80 ADD BOT TO NOVA REG
FE46 B6 C009 SH1 LDA ZR240 RELOAD A
FE49 85 08 BITA #$8 IF READY, ALSO TEST WRITE LOC
FE4B 26 02 BNE SH2 IF BIT IS ON, IS UNPROTECTED
FE4D CA 04 ORB #$4
FE4F F7 C005 SH2 STB ZNAL OK, STORE IN LOW HALF OF DIA
FE52 C4 22 ANDB #ERRBL TEST THE BITS THAT CAUSE ERR FLA
FE54 D7 17 STB ERRLBIT SAVE TEMPORARILY
FE56 D6 0D LDB STATUS NOW BUILD UPPER BYTE OF STATUS
FE58 C4 DF ANDB #LACHH EXTRACT LATCHED BITS
FE5A 85 02 SH3 BITA #$2 TEST FWD, REV AND BUSY TO GET
FE5C 27 08 BEQ SH5 IF NOT BUSY, IS NOT REWINDIN
FE5E 96 14 LDA LCOMM WHAT WAS THE LAST COMMAND
FE60 81 08 OMPA #$8 IF REW, THEN SET REW STATUS B
FE62 26 02 BNE SH5
FE64 CA 20 ORB #$20 IS REWINDING, SET STATUS BIT
FE66 0000 SH5 RMB 0

* NOW FIND OUT WHETHER ERROR BIT (MSB) SHOULD BE ON

FE66 1F 98 TFR B,A
FE68 84 57 ANDA #ERRBH THESE BITS CAUSE ERR IN UPPER HA
FE6A 9A 17 ORA ERRLBIT THESE CAUSE ERR IN LOWER HALF
FE6C 27 02 BEQ SH4
FE6E CA 80 ORB #$80 IF ANY ARE ON, SET IT
FE70 F7 C004 SH4 STB ZNAH OK, SEND IT TO NOVA
FE73 39 RTS

*
* WAIT-- SUBROUTINE TO WAIT N MSEC. ENTER WITH N IN X.
FE74 86 D7 WAIT LDA #215 LOOP TO WAIT 1 MS
FE76 4A WAITL DECA [2] LOOP TO WAIT 5 USEC
FE77 12 NOP [2]
FE78 26 FC BNE WAITL [3]
FE7A 30 1F LEAX -1,X
FE7C 8C 0000 CMPX #0 DECR X AND TEST IF 0
FE7F 26 F3 BNE WAIT
FE81 39 RTS

```

* SUBROUTINE TO TEST FOR EOT (BEFORE GOING FORWARD)
 * REWINDS AND GOES TO NEXT TRACK IF NECESSARY
 * GOES DIRECTLY TO ECOMM IF LAST TRACK
 * IF REV DIRECTION, GOES BACK A TRACK, FAST FWDS
 * TO END OF TRACK

FE82	96	1C	TSTEOT	LDA	TAPDIR	WHICH DIREC
FE84	81	02		CMPA	#\$2	FWD?
FE86	26	2F		BNE	REVEOT	NO, SKIP
FE88	B6	C009		LDA	ZR240	TEST EWS
FE8B	85	20		BITA	#\$20	
FE8D	27	27		BEQ	RNOTE	IF OFF, OK
FE8F	96	0F		LDA	MPORTB	IF ON, TEST TRACK#
FE91	84	03		ANDA	#\$3	
FE93	81	03		CMPA	#\$3	TEST FOR TRACK 4
FE95	26	0B		BNE	RNOT4	IF NOT 4, REWIND & RETRY
			* TRACK 4 NOW-	RETURN	EOT STATUS TO NOVA	
FE97	86	02		LDA	#2	
FE99	9A	0D	BADEOT	ORA	STATUS	
FE9B	97	0D		STA	STATUS	
FE9D	35	06		PULS	D	DUMP THE STACK BEFORE LEAVI
FE9F	7E	F8A4		JMP	ECOMM	
			* NOT TRACK 4-	REWIND		
FEA2	8D	43	RNOT4	BSR	ESTOP	STOP THE TAPE
FEA4	D6	0F		LDB	MPORTB	SET UP NEW TRACK #
FEA6	5C			INCB		NEXT TRACK
FEA7	D7	0F		STB	MPORTB	
FEA9	F7	C008		STB	DPORTB	
FEAC	BD	F8F0		JSR	REWI	START MOTION
FEAF	B6	C009	R5	LDA	ZR240	WAIT TILL BUSY GOES DOWN
FEB2	85	02		BITA	#\$2	
FEB4	26	F9		BNE	R5	
FEB6	39		RNOTE	RTS		
FEB7	B6	C009	REVEOT	LDA	ZR240	TEST PHYSICAL BOT
FEBA	85	50		BITA	#\$50	LOOK FOR LPS OR FLG
FEBC	27	F8		BEQ	RNOTE	IF NOT, RETURN OK
FEBE	96	0F		LDA	MPORTB	IS BOT, TEST TRACK#
FEC0	85	03		BITA	#\$3	
FEC2	26	0A		BNE	RNOTZ	IF NOT ZERO
FEC4	86	80		LDA	#\$80	IF ZERO, RETURN ERROR
FEC6	9A	0E		ORA	STATUS+1	BIT 7 IN LOWER BYTE IS BOT
FEC8	97	0E		STA	STATUS+1	
FECA	86	90		LDA	#\$90	SET ERR FLAG AND ILLEG
FECC	20	CB		BRA	BADEOT	
FECE	8D	17	RNOTZ	BSR	ESTOP	STOP MOTION
FED0	96	0F		LDA	MPORTB	GET TRACK #
FED2	4A			DECA		REDUCE IT BY 1
FED3	97	0F		STA	MPORTB	
FED5	B7	C008		STA	DPORTB	SET TRK# IN DRIVE
FED8	86	06		LDA	#\$06	FAST & FORWARD BITS
FEDA	B7	D001		STA	ZPORTA	START MOTION
FEDD	B6	C009	WEWS	LDA	ZR240	WAIT FOR EWS (END-OF-TRACK)
FEE0	85	20		BITA	#\$20	
FEE2	27	F9		BEQ	WEWS	
FEE4	8D	01		BSR	ESTOP	STOP MOTION
FEE6	39			RTS		

* ROUTINE STOPS TAPE MOTION, WAITS UNTIL DRIVE
 * IS READY, CLEARS WRITE ENABLE, WAITS 2 MORE MS
 * AND RETURNS.

```

FEE7 B6 D001 ESTOP LDA ZPORTA
FEEA 84 FC ANDA #$FC ZERO THE MOTION BITS
FEED B7 D001 STA ZPORTA
FEFF B6 C009 ESTOP2 LDA ZR240 WAIT FOR BUSY BIT IN
FEF2 85 02 BITA #$02 DRIVE TO GO LOW.
FEF4 26 F9 BNE ESTOP2
FEF6 7F D001 CLR ZPORTA TURN OFF WEN (IT MAY OR
FEF9 8E 0002 LDX #2 MAY NOT HAVE BEEN ON)
FEFC BD FE74 JSR WAIT 2MS DELAY BEFORE TRACK
FEFF 39 RTS CHANGE ALLOWED

```

* INTERRUPT ROUTINE (FOR FIRQ INTERRUPT)

* HAS DIFFERENT MODES FOR READ & WRITE

```

FF00 34 06 FIRQ PSHS D STACK A,B
FF02 96 18 LDA INTRW WHICH MODE WE IN
FF04 1027 FB85 LBEQ FIRQR IF READ

```

* THE WRITE INTERRUPT ROUTINE GOES HERE

```

FF08 B6 D800 LDA ZSYNC0 GET ERROR STATUS
FF0B 84 C0 ANDA #$C0 IF DAD OR CTS WENT DOWN -
FF0D 27 17 BEQ PERR ITS A BAD TAPE, ELSE PARITY
FF0F 96 0E LDA STATUS+1 BAD TAPE - SET STATUS BIT
FF11 8A 20 ORA #$20
FF13 97 0E STA STATUS+1
FF15 86 03 LDA #$03 RESET THE USRT
FF17 B7 D800 STA ZSYNC0
FF1A 86 31 LDA #$31 DISABLE EIE
FF1C B7 D802 STA ZSYNC1
FF1F 32 65 LEAS 5,S CLEAN STACK
FF21 1C EF ANDCC #$EF ENABLE IRQ
FF23 16 FE1F LBRA WBENT GO ABORT WRITE

```

```

FF26 96 0D PERR LDA STATUS COULD BE RCV OVFL, XMT UNDRFL
FF28 8A 04 ORA #$4 OR PARITY
FF2A 97 0D STA STATUS CALL IT PARITY ERROR.
FF2C B6 D802 LDA ZSYNC1
FF2F 4F CLRA
FF30 B7 D800 STA ZSYNC0 NO POINT ALLOWING FURTHER
FF33 86 31 FIRQX LDA #$31 FIRQ'S ON THIS WRITE, SO
FF35 B7 D802 STA ZSYNC1 DISABLE EIE
FF38 35 06 PULS D
FF3A 3B RTI

```

* TEST PROGRAMS

* THESE ARE DESIGNED FOR USE DURING THE CHECKOUT PHASE
 * IN ADDITION TO THESE PROGRAMS, THE 'READ', 'REW',
 * AND OTHER COMMAND ROUTINES MAY BE ENTERED AS
 * TEST PROGRAMS IF 'SELU0' HAS BEEN CALLED AND THE
 * STACK HAS BEEN INITIALIZED TO \$EBFF.
 * SET UP NOVCOM, NOVADD, NOVWC BEFORE ENTERING.

* PROGRAM TO INITIALIZE EVERYTHING, USING SELU0

* THIS SHOULD BE CALLED BEFORE ANY OF THE OTHER TEST PROGS

FF3B 86	E8	FIRST	LDA	#\$E8	SET UP DP REGISTER
FF3D 1F	8B		TFR	A,DP	
FF3F BD	FDC9		JSR	SELU0	
FF42 7E	F8A4		JMP	ECOMM	

* PROGRAM TO READ A WORD FROM NOVA VIA DMA

* XX: ADDRESS IN NOVA [E800]

* YY: CONTENTS WILL BE RETURNED HERE [E802]

FF45 86	00	READWD	LDA	#0	SET DIRECTION- NOVA OUT
FF47 B7	C008		STA	DPORTB	
FF4A DC	00		LDD	XX	SET UP MEM ADDR
FF4C FD	C002		STD	ZNBH	
FF4F B7	C009		STA	ZDCHR	ASK FOR CYCLE
FF52 B6	D000	RWAIT	LDA	ZPORTB	WAIT FOR DONE
FF55 2A	FB		BPL	RWAIT	BIT 7 MUST GO HIGH
FF57 FC	C006		LDD	ZNDH	GET RESULT
FF5A DD	02		STD	YY	
FF5C 7E	FF5C	HERE	JMP	HERE	DONE

* PROGRAM TO WRITE A WORD INTO NOVA MEMORY

* XX: ADDRESS IN NOVA

* YY: THE WORD TO WRITE

FF5F 86	20	WRITWD	LDA	#\$20	SET DIRECTION- INTO NOVA
FF61 B7	C008		STA	DPORTB	
FF64 DC	00		LDD	XX	SET UP ADDRESS
FF66 FD	C002		STD	ZNBH	
FF69 DC	02		LDD	YY	CONTENTS
FF6B FD	C006		STD	ZNDH	
FF6E B7	C009		STA	ZDCHR	ASK FOR CYCLE
FF71 B6	D000	WWAIT	LDA	ZPORTB	
FF74 2A	FB		BPL	WWAIT	
FF76 7E	FF5C		JMP	HERE	

* INTERRUPT ROUTINES

FF79 7E	FF79	HSWI	JMP	HSWI	SWI
FF7C 6E	9F F7FC	DEBUG	JMP	[\$F7FC]	NMI- TO DEBUGGER

FFF6		ORG	\$FFF6	
FFF6	FF00	FDB	FIRQ	FIRQ
FFF8	FA52	FDB	HIRQ	IRQ
FFFA	FF79	FDB	HSWI	SWI
FFFC	FF7C	FDB	DEBUG	NMI
FFFE	F800	FDB	INIT	INITIAL START

END

NUMBER OF SOURCE LINES = 1301

TOTAL ERRORS = 0 TOTAL WARNINGS = 0


```

      OPT      MC,MEX,G
CLC      MACR
      ANDCC    #$FE
      ENDM
SEC      MACR
      ORCC     #01
      ENDM
CLI      MACR
      ANDCC    #$EF
      ENDM
SEI      MACR
      ORCC     #$10
      ENDM
INX      MACR
      LEAX     1,X
      ENDM
DEX      MACR
      LEAX     -1,X
      ENDM
INS      MACR
      LEAS     1,S
      ENDM
TSX      MACR
      TFR      S,X
      ENDM
TXS      MACR
      TFR      X,S
      ENDM
DES      MACR
      LEAS     -1,S
      ENDM
CBA      MACR
      PSHS     B
      CMPA     ,S+
      ENDM
ASLD     MACR
      ASLB
      ROLA
      ENDM

```

NAM DEB09

12 21, 198

```

*****
*
*      COMPUTER IMAGE RPU DEBUGGER
*      6809 DEBUGGER
*
*****

```

E830

ORG \$E830

* DEBUGGER PAGE ZERO REGISTERS

```

E830      0001  CHAR      RMB      1
E831      0001  TMR       RMB      1
E832      0002  ARA       RMB      2
E834      0002  ARB       RMB      2

```

SERIAL INPUT CHAR.

TIMER

```

16 BIT ARITH PSEUDO RE
16 BIT ARITH PSEUDO RE

```

E836	0008	CHRBUF	RMB	8	PTR TO TEXT START
E83E	0001	BRKSAV	RMB	1	TEMP SAVE FOR BRKPOINT
E83F	0002	STKPTR	RMB	2	STACK POINTER SAVE ARE
E841	0002	BRKADR	RMB	2	ADDR. OF BREAKPOINT.
E843	0002	TMP	RMB	2	
E845	0002	TMP1	RMB	2	
E847	0001	TMPF	RMB	1	TEMP FOR MEM TEST
E848	0001	TMPC	RMB	1	RPU TEMP
E849	0002	PCVAL	RMB	2	
E84B	0001	NUMDIG	RMB	1	NUMBER OF DIGITS TO OU
E84C	0001	LZFLG	RMB	1	LEADING ZERO FLAG
E84D	0002	BEGADR	RMB	2	MEMORY TEST BEG ADR
E84F	0002	ENDADR	RMB	2	MEMORY TEST END ADR
E851	0001	CHR2	RMB	1	SERIAL INPUT CHAR FOR
E852	0001	UNITN	RMB	1	RAM LOAD UNIT (0=TERM=
E853	0001	CKSM	RMB	1	RAM LOAD CHECKSUM
E854	0001	BYTCT	RMB	1	RAM LOAD BYTECOUNT
E855	0002	FINTA	RMB	2	FAST INTERRUPT VECTOR
E857	0002	INTA	RMB	2	IRQ INTERRUPT VECTOR

```

      8000 ACIADR EQU $8000 ;EXTERNAL DECODE LOGIC POD
      8001 ACIASR EQU ACIADR+1
      8002 ACIACD EQU ACIADR+2
      8003 ACIACR EQU ACIADR+3

      *
      * CHARACTER CONSTANTS
      *
      0008 BS EQU $08 BACKSPACE
      007F DEL EQU $7F DELETE
      *
      * INITIAL STACK POINTER LOCATION
      *
      EC00 STKINI EQU $EC00

F000
      00E8 ORG $F000
      SETDP $E8

      * INITIALIZATION ROUTINES

F000 86 09 RESTRT LDA #%00001001 ENABLE ACIA RECV INTERRUPTS
F002 B7 8002 STA ACIACD
F005 86 1C LDA #$1C SET ACIA 4800 BAUD -
F007 B7 8003 STA ACIACR & 1 STOP BIT (NO PARITY)
F00A 0F 30 CLR CHAR CLEAR SERIAL CHAR
F00C 39 RTS

      *
      * IRQ & FIRQ INTERRUPT HANDLING.
      * SET INTA AND/OR FINTA TO POINT TO YOUR INTERRUPT HANDLERS
      *
F00D 6E 9F E857IRQ1A JMP [INTA]
F011 6E 9F E855FIRQA JMP [FINTA]
```

*
* ACIA2 DEFINITIONS / INITIALIZATION / INTERRUPT HANDLER
*
* ACIA2 IS AN ALTERNATE SERIAL PORT FOR LOADING PROGRAMS
* OR DATA INTO RAM
*

* ACIA2 REGISTER DEFINITIONS
*

8000 ACI2DR EQU \$8000
8001 ACI2SR EQU ACI2DR+1
8002 ACI2CD EQU ACI2DR+2
8003 ACI2CR EQU ACI2DR+3

*
* INITIALIZATION ROUTINE FOR ACIA2
*

F015 86	09	UN2INI	LDA	#\$00001001	ENABLE RECV INTERRUPTS (ON CH
F017 B7	8002		STA	ACI2CD	
F01A 86	1C		LDA	#\$1C	SET ACIA2 TO 4800 BAUD
F01C B7	8003		STA	ACI2CR	
F01F 0F	51		CLR	CHR2	CLEAR ACIA2'S CHAR BUFFER
			CLI	CLEAR	INTERRUPT
F021 1C	EF		ANDCC	#\$EF	
F023 39			RTS		

*
* ACIA2 INTERRUPT HANDLER
*

F024 B6	8000	ACI2IN	LDA	ACI2DR	INPUT THE CHAR
F027 97	51		STA	CHR2	PUT IT IN ACIA2'S CHAR BU
F029 3B			RTI		


```

*****
*           6809 DEBUGGER ROUTINE           *
*           APPROX 960 BYTES                 *
*                                           *
*****

```

```

*           HERE ARE THE SERIAL I/O ROUTINES FOR THE 6809
*           INTERNAL ACIA

```

```

F02A 96    30    GETCHR  LDA    CHAR           GET RECIEVED CHARACTER
F02C 27    FC           BEQ    GETCHR         NOT READY
F02E 84    7F           ANDA   #$7F          MASK OFF PARITY BIT
F030 0F    30           CLR    CHAR
F032 39

```

```

*           ACIA IN INTERRUPT

```

```

F033 B6    8001  SERINI  LDA    ACIASR        GET STATUS
F036 85    02           BITA   #$02          CHECK FOR BREAK CHAR
F038 26    06           BNE    BREAKF        GO BREAK
F03A B6    8000          LDA    ACIADR        GET CHAR
F03D 97    30           STA    CHAR          SAVE IT
F03F 3B
F040 B6    8000  BREAKF  LDA    ACIADR        CLEAR INT
F043 20    76           BRA    BKENTR

```

```

F045 34    06    PUTCHR  PSHS   B,A
F047 F6    8001  PUTCH1  LDB    ACIASR        GET STATUS REG
F04A C5    10           BITB   #$10          CK IF XMIT BUFFER EMPTY
F04C 27    F9           BEQ    PUTCH1
F04E B7    8000          STA    ACIADR        OUTPUT THE CHARACTER
F051 81    0D           CMPA   #$D
F053 26    04           BNE    PUTCHX
F055 86    0A          LDA    #$A
F057 20    EE          BRA    PUTCH1

F059 35    06    PUTCHX  PULS   A,B
F05B 39

```

```

*           INPUT A CHARACTER STRING TERMINATED W/ A C.R. OR ESC

```

```

F05C 8E    E836  EDITOR  LDX    #CHRBUF      GET CHAR BUFFER ADDRESS
F05F 8D    C9    EDIT1  BSR    GETCHR        GET A KBD CHAR
F061 81    7F           CMPA   #DEL          COMPARE TO DELETE
F063 27    0B           BEQ    DELETE
F065 A7    80           STA    0,X+         PUT IT IN THE BUFFER
F067 81    0D           CMPA   #$D          CK FOR A C.R.
F069 27    04           BEQ    EDITX
F06B 81    1B          CMPA   #$1B
F06D 26    0E          BNE    EDIT2
F06F 39
F070 8C    E836  EDITX  RTS
F073 27    EA    DELETE  CMPX   #CHRBUF      DONT BACKUP TOO FAR
F075 86    08           BEQ    EDIT1        TOO FAR
F077 8D    CC          LDA    #BS          BACKSPACE
                                BSR    PUTCHR

```

F079 30	1F	DEX	BACKUP	POINTER	
F07B 20	E2	LEAX	-1,X		
		BRA	EDIT1		
F07D 8D	C6	EDIT2	BSR	PUTCHR	GO OUTPUT THE CHARACTER
F07F 20	DE	BRA	EDIT1		

* OUTPUT DEBUG TEXT STRING TO ACIA

F081	A6	80	PRTEXT	LDA	0,X+	LOAD ACCA WITH CHAR
F083	27	0E		BEQ	EXITXT	
F085	81	5E		CMPA	#'^	CHECK FOR END CHARACTER
F087	27	0A		BEQ	EXITXT	
F089	81	40		CMPA	#'Q	TEST FOR SIMULATE C.R.
F08B	26	02		BNE	PCHR	
F08D	86	0D		LDA	#\$0D	YES GET C.R.
F08F	8D	B4	PCHR	BSR	PUTCHR	PRINT CHARACTER
F091	20	EE		BRA	PRTEXT	BRA TO DO NEXT CHARACTER
F093	39		EXITXT	RTS		

F094	86	20	SPA	LDA	#'	PRINT ONE SPACE
F096	20	AD		BRA	PUTCHR	

F098	86	0D	CRLF	LDA	#\$D	PRINT A C.R.
F09A	20	A9		BRA	PUTCHR	

F09C	8D	F6	ERROR	BSR	SPA	DO A SPACE
F09E	86	3F	ERROR1	LDA	#'?	DO A '?'
F0A0	20	A3		BRA	PUTCHR	

F0A2	8D	86	INPCHR	BSR	GETCHR	
F0A4	81	1B	INPCH1	CMPA	#\$1B	CK FOR ESC CHAR
F0A6	27	02		BEQ	INPCX	IF SO, DON'T PRINT IT
F0A8	8D	9B		BSR	PUTCHR	
F0AA	39		INPCX	RTS		

F0AB	86	0D	NEWLIN	LDA	#\$0D	LOADS A CARRIAGE RETURN
F0AD	8D	96		BSR	PUTCHR	
F0AF	86	21	NEWLN1	LDA	#'!	LOADS A PROMPT CHARACTER
F0B1	20	92		BRA	PUTCHR	

* INPUT 16 BIT NUMBER INTO THE A:B REGISTER

F0B3	8D	A7	INPNUM	BSR	EDITOR	INPUTS A STRING OF DIGITS
F0B5	8E	E836		LDX	#CHRBUF	LOADS ADDR OF FIRST DIGIT
F0B8	16	047F		LBRA	ASCBIN	CONVERTS TO BINARY # IN A:B

* BREAKPOINT ENTRY USED BY SWI

F0BB 10DF 3F	BKENTR	STS	STKPTR	SAVE STACK POINTER
F0BE EC 6A		LDD	10,S	LOADS RETURN ADDRESS
F0C0 83 0001		SUBD	#1	SUB 1 FROM RETURN ADDRESS
F0C3 ED 6A		STD	10,S	RESTORES RETURN ADDRESS
F0C5 8E F661		LDX	#RGTEXT	PRINT REGISTER HEADINGS
F0C8 8D B7		BSR	PRTEXT	
		TSX		
F0CA 1F 41		TFR	S,X	
F0CC 8D 3C		BSR	PRTREG	PRINT REGISTER VALUES
F0CE B6 8001	BLOOP	LDA	ACIASR	CHECK FOR BREAK -
F0D1 85 04		BITA	#\$04	STILL IN PROGRESS
F0D3 27 05		BEQ	GOBUG	WAIT
F0D5 B6 8000		LDA	ACIADR	CLEAR INT
F0D8 20 F4		BRA	BLOOP	
	GOBUG	CLI		
F0DA 1C EF		ANDCC	#\$EF	
F0DC 20 44		BRA	DEBUG	
F0DE E6 80	CVBIN	LDB	0,X+	GET C.C. REG DATA
F0E0 8D 03		BSR	CVBIN1	CONVERT TO BINARY
F0E2 8D B0		BSR	SPA	PRINT A SPACE
F0E4 39		RTS		
F0E5 86 08	CVBIN1	LDA	#8	GET COUNTDOWN VALUE
F0E7 97 45	BINEXT	STA	TMP1	
F0E9 58		ASLB		GET BINARY DIGIT
F0EA D7 46		STB	TMP1+1	SAVE REMAINDER OF DATA
F0EC 25 04		BCS	PRINT1	
F0EE 86 30		LDA	#0	
F0F0 20 02		BRA	PRTBIN	
F0F2 86 31	PRINT1	LDA	#1	
F0F4 17 FF4E	PRTBIN	LBSR	PUTCHR	JUMP TO PRINT 0 OR 1
F0F7 DC 45		LDD	TMP1	
F0F9 4A		DECA		
F0FA 26 EB		BNE	BINEXT	
F0FC 39		RTS		
F0FD 8D 05	OUT4HX	BSR	OUT2CH	
F0FF 8D 03	OUT2HX	BSR	OUT2CH	
F101 8D 91		BSR	SPA	
F103 39		RTS		
F104 A6 80	OUT2CH	LDA	0,X+	
F106 17 0149		LBSR	PNTBYT	
F109 39		RTS		
	*			
	* PRINT REGISTER CONTENTS			
	*			
F10A 8D D2	PRTREG	BSR	CVBIN	BRA TO CONVERT C.C. REG
F10C 8D F1		BSR	OUT2HX	PRINT ACC A
F10E 8D EF		BSR	OUT2HX	PRINT ACC B
F110 8D ED		BSR	OUT2HX	PRINT DP
F112 8D E9		BSR	OUT4HX	PRINT X INDEX REG
F114 8D E7		BSR	OUT4HX	PRINT Y INDEX REG
F116 8D E5		BSR	OUT4HX	PRINT U INDEX PTR.

F118 8D	E3	BSR	OUT4HX	PRINT PROGRAM COUNTER
F11A 8E	E83F	LDX	#STKPTR	
F11D 8D	DE	BSR	OUT4HX	PRINT STACK POINTER
F11F 39		RTS		

```

*****
*
*          ACTUAL DEBUGGER PROGRAM
*
*****

```

F120 32	62	POPLIN	LEAS	2,S	CLEANS UP STACK FOR DISF OF C.R. >
F122 8D	87	DEBUG	BSR	NEWLIN	PRINTS "C.R.>"
F124 17	FF7B	DEBUG1	LBSR	INPCHR	READS IN COMMAND
F127 8E	F13C	DEB11	LDX	#DEBTBL	GET DEBUG COMMAND TABLE
F12A A1	84	DEBUG2	CMPA	0,X	
F12C 27	09		BEQ	DEBGO	GO IF A MATCH IS FOUND
F12E 8C	F178		CMPX	#DEBTX	CK FOR END OF TABLE
F131 27	04		BEQ	DEBGO	BRA IF A MATCH
F133 30	03		LEAX	3,X	
F135 20	F3		BRA	DEBUG2	GO BACK FOR NEXT MATCH
F137 AD	98 01	DEBGO	JSR	[1,X]	JUMP TO THE SUBROUTINE
F13A 20	E8		BRA	DEBUG1	
F13C	2F	DEBTBL	FCB	'/'	OPEN CURRENT LOCATION
F13D	F1E6		FDB	OPNCUR	
F13F	43		FCB	'C	CLEAR BREAK
F140	F17B		FDB	CLRBRK	
F142	20		FCB	'	CHANGE MEMORY CONTENTS
F143	F18C		FDB	CHANGE	
F145	2B		FCB	'+'	OPEN NEXT LOCATION
F146	F195		FDB	OPNNXT	
F148	2D		FCB	'-	OPEN PREVIOUS LOCATION
F149	F19E		FDB	OPNPRE	
F14B	42		FCB	'B	SET A BREAK POINT
F14C	F1A7		FDB	BRKSET	
F14E	45		FCB	'E	EXECUTE (SET REG VALS &
F14F	F269		FDB	EXESBR	
F151	47		FCB	'G	JUMP TO OPENED LOCATION
F152	F1D4		FDB	GOLOCN	
F154	4A		FCB	'J	JSR TO OPENED LOCATION
F155	F1DC		FDB	JMPLCN	
F157	4F		FCB	'O	OPEN A LOCATION
F158	F1EC		FDB	OPNLOC	
F15A	52		FCB	'R	RETURN FROM INTERRUPT
F15B	F22C		FDB	RTFINT	
F15D	53		FCB	'S	OPEN CURRENT STACK POIN
F15E	F22F		FDB	OPNSTK	
F160	13		FCB	\$13	SET STACK POINTER TO OPE
F161	F1BC		FDB	SETSTK	
F163	4D		FCB	'M	MEMORY TEST
F164	F6C3		FDB	MEMTST	
F166	50		FCB	'P	PRINT REGISTER VALUES
F167	F39C		FDB	PREGS	
F169	4C		FCB	'L	LOAD PROGRAM/DATA INTO
F16A	F2CF		FDB	LODRAM	
F16C	48		FCB	'H	HELP: PRINT DEB COMMAND
F16D	F3AA		FDB	HELP	

F16F
F170
F172
F173

58
F235
0D
F0AF

FCB
FDB
FCB
FDB

'X
EXITD
\$D
NEWLN1

EXIT DEBUGGER

C.R. TERMINATOR

F175	1B		FCB	\$1B	ESC TERMINATOR
F176	F0AB		FDB	NEWLIN	
F178	00	DEBTX	FCB	0	
F179	F1CB		FDB	DEBERR	
F17B 9E	41	CLRBRK	LDX	BRKADR	GETS ADDRESS OF BRKPNT
F17D 96	3E		LDA	BRKSAV	LOADS ORIG BYTE CONTENTS
F17F A7	84		STA	0,X	RESTORES BYTE DATA
F181 9F	49		STX	PCVAL	
F183 8E	F696		LDX	#CLTXT	
F186 17	FEF8		LBSR	PRTEXT	PRINT "CLR BRK"
F189 16	00B2		LBRA	DSPAD1	
F18C 17	FF24	CHANGE	LBSR	INPNUM	INPUTS NEW BYTE CONTENTS
F18F 9E	49	CHANG1	LDX	PCVAL	LOADS OPENED BYTE LOCATION
F191 E7	84		STB	0,X	STORES NEW BYTE CONTENTS
F193 20	02		BRA	OPNXT1	
F195 9E	49	OPNNXT	LDX	PCVAL	
		OPNXT1	INX	FORMS	NEXT LOCATION ADDRESS
F197 30	01		LEAX	1,X	
F199 17	00A0		LBSR	DSPADR	GOES TO OPEN LOCATION BYTE
F19C 20	58		BRA	NCHG	
F19E 9E	49	OPNPRE	LDX	PCVAL	
			DEX	FORMS	PREV LOCATION ADDR
F1A0 30	1F		LEAX	-1,X	
F1A2 17	0097		LBSR	DSPADR	GOES TO OPEN THE LOCATION
F1A5 20	4F		BRA	NCHG	
F1A7 9E	49	BRKSET	LDX	PCVAL	
F1A9 A6	84		LDA	0,X	LOADS DATA OF OPENED LOC
F1AB 97	3E		STA	BRKSAV	SAVES DATA OF OPENED BYTE
F1AD 9F	41		STX	BRKADR	SAVES ADDR OF BREAKPOINT
F1AF 86	3F		LDA	#\$3F	LOADS SOFTWARE INTRUP COM
F1B1 A7	84		STA	0,X	SETS A SWI AT OPENED BYT
F1B3 8E	F68E		LDX	#BKTXT	PRINT "BREAK"
F1B6 17	FEC8		LBSR	PRTEXT	
F1B9 16	FF64		LBRA	POPLIN	GOES TO NEXT LINE FOR COMM
F1BC 10DE	49	SETSTK	LDS	PCVAL	
F1BF 10DF	3F		STS	STKPTR	
F1C2 8E	F6A4		LDX	#SKTXT	PRINT "SET STACK"
F1C5 17	FEB9		LBSR	PRTEXT	
F1C8 16	FF57		LBRA	DEBUG	RETURNS TO INPUT COMMAND
F1CB 8E	F6B0	DEBERR	LDX	#OPTTEXT	
F1CE 17	FEB0		LBSR	PRTEXT	PRINT "INVAL COMM"
F1D1 16	FF4C	RETRN1	LBRA	POPLIN	
F1D4 9E	49	GOLOCN	LDX	PCVAL	
F1D6 10CE	EC00		LDS	#STKINI	CLEAN STACK ON GO
F1DA 6E	84		JMP	0,X	JUMP TO USER PROGRAM
F1DC 9E	49	JMPLCN	LDX	PCVAL	
F1DE 10CE	EC00		LDS	#STKINI	CLEAN STACK ON JSR

F1E2 AD 84
F1E4 20 EB

JSR 0,X
BRA RETRN1

F1E6 9E	49	OPNCUR	LDX	PCVAL	OPEN CURRENT LOC IN PCVAL
F1E8 8D	52		BSR	DSPADR	
F1EA 20	0A		BRA	NCHG	

F1EC 17	FEA5	OPNLOC	LBSR	SPA	
F1EF 17	FEC1		LBSR	INPNUM	LOADS A 16 BIT NUMBER
F1F2 DD	49		STD	PCVAL	STORES NEWLY OPENED LOCAT
F1F4 8D	4D		BSR	DSPAD2	DISPLAYS CONTENTS OF LOCAT

*
* HAVING JUST DISPLAYED THE OPEN LOCATION, IF NEXT
* INPUT IS A HEX CHARACTER - TREAT IT AS A CHANGE
*

F1F6 17	FE31	NCHG	LBSR	GETCHR	GET NEXT INPU CHAR
F1F9 81	30		CMPA	#\$30	
F1FB 2B	27		BMI	NEX	<0 IS NOT HEX
F1FD 81	39		CMPA	#\$39	
F1FF 2F	08		BLE	CHG	0-9 IS O.K. FOR CHANGE
F201 81	41		CMPA	#\$41	
F203 2B	1F		BMI	NEX	<A IS NOT HEX
F205 81	46		CMPA	#\$46	
F207 2E	1B		BGT	NEX	>F IS NOT HEX
F209 1F	89	CHG	TFR	A,B	SAVE CHAR
F20B 17	FE86		LBSR	SPA	PRINT A SPACE
F20E 1F	98		TFR	B,A	GET CHAR BACK
F210 17	FE32		LBSR	PUTCHR	ECHO IT
F213 8E	E836		LDX	#CHRBUF	
F216 A7	80		STA	0,X+	STORE CHAR
F218 17	FE44		LBSR	EDIT1	GET REST OF CHANGE DATA
F21B 8E	E836		LDX	#CHRBUF	
F21E 17	0319		LBSR	ASCBIN	CONVERT IT TO BINARY
F221 16	FF6B		LBRA	CHANG1	
F224 17	FE7D	NEX	LBSR	INPCH1	ECHO CHAR IF NOT ESC
F227 32	62		LEAS	2,S	CLEAN STACK
F229 16	FEFB		LBRA	DEB11	BACK TO PROCESS CHAR AS C

F22C 32	62	RTFINT	LEAS	2,S	CLEANS UP THE STACK
F22E 3B			RTI		RETURNS FROM BR

		OPNSTK	TSX	GET	TOP OF THE STACK
F22F 1F	41		TFR	S,X	
F231 30	02		LEAX	2,X	
F233 20	07		BRA	DSPADR	

F235 10CE	00FF	EXITD	LDS	#\$FF	
F239 16	FEE6		LBRA	DEBUG	

* DISPLAY LOCATION ADDRESS & CONTENTS

F23C 9F	49	DSPADR	STX	PCVAL	SAVES OPENED LOCATION ADD
F23E 17	FE6A	DSPAD1	LBSR	NEWLIN	PRINTS A "C.R." AND "I"
F241 8D	09		BSR	PNTDIG	PRINTS OUT "PCVAL" IN HEX
F243 17	FE4E	DSPAD2	LBSR	SPA	
F246 9E	49		LDX	PCVAL	LOADS PTR TO OPENED LOCAT
F248 A6	84		LDA	0,X	LOADS DATA FROM LOCATION
F24A 20	06		BRA	PNTBYT	PRINTS DATA IN HEX FORMAT

F24C 96	49	PNTDIG	LDA	PCVAL	PRINTS THE 2 HI HEX DIGITS
F24E 8D	02		BSR	PNTBYT	OF THE OPENED ADDRESS
F250 96	4A		LDA	PCVAL+1	PRINTS OUT 2 LO HEX DIGITS

* PRINT OUT 2 HEX DIGITS

F252 34	02	PNTBYT	PSHS	A	SAVE FOR LO DIGIT CONV
F254 44			LSRA		
F255 44			LSRA		SHIFT HI NIBBLE
F256 44			LSRA		
F257 44			LSRA		
F258 8D	04		BSR	PNTASC	GO CONVERT TO ASCII
F25A 35	02		PULS	A	RETRIEVE ORIG
F25C 84	0F		ANDA	#\$F	MASK OFF HI NIBBLE
F25E 8B	30	PNTASC	ADDA	#\$30	CONVERT TO ASCII
F260 81	39		CMPA	#\$39	CK IF HEX
F262 23	02		BLS	PNTBF1	
F264 8B	07		ADDA	#7	CONVERT TO HEX CHAR
F266 16	FDDC	PNTBF1	LBRA	PUTCHR	DISPLAYS CHARACTER

*
* E - EXECUTE. SET REGISTER VALUES & GOTO (PC)
*

F269 32	6A	EXESBR	LEAS	10,S	MAKE SPACE FOR 12 BYTES
F26B 86	0A		LDA	#10	
F26D 8E	F2A7		LDX	#PCVM	
F270 8D	18	EXES1	BSR	EXES5	EACH TIME: PRINT "PC=" (PC)
F272 4A			DECA		GET VALUE & STOP
F273 4A			DECA		ON STACK.
F274 30	05		LEAX	5,X	
F276 81	04		CMPA	#04	
F278 2C	F6		BGE	EXES1	
F27A 4C			INCA		
F27B 8D	1D	EXES2	BSR	EXES7	1 BYTE REGS:PRINT, GET VAL
F27D 4A			DECA		& STORE IN DP,B,
F27E 30	05		LEAX	5,X	ON STACK.
F280 4D			TSTA		
F281 2C	F8		BGE	EXES2	
F283 E6	E4		LDB	0,S	FOR CC, MAKE SURE E IS S
F285 CA	80		ORB	#\$80	
F287 E7	E4		STB	0,S	
F289 3B			RTI		PULL REGS FROM S
F28A 34	02	EXES5	PSHS	A	FOR 2 BYTE REGS: PRINT
F28C 17	FDF2		LBSR	PRTEXT	GET VAL & STORE IT.
F28F 17	FE21		LBSR	INPNUM	
F292 1F	02		TFR	D,Y	
F294 35	02		PULS	A	
F296 10AF	E6		STY	A,S	
F299 39			RTS		
F29A 34	02	EXES7	PSHS	A	FOR 1 BYTE REGS AS EXE
F29C 17	FDE2		LBSR	PRTEXT	
F29F 17	FE11		LBSR	INPNUM	
F2A2 35	02		PULS	A	
F2A4 E7	E6		STB	A,S	
F2A6 39			RTS		

*
* REGISTER PROMPTS
*

F2A7	20	PCVM	FCC	"	PC="^"
F2A8	50				
F2A9	43				
F2AA	3D				
F2AB	5E				
F2AC	20		FCC	"	U="^"
F2AD	20				
F2AE	55				
F2AF	3D				
F2B0	5E				
F2B1	20		FCC	"	Y="^"
F2B2	20				
F2B3	59				
F2B4	3D				
F2B5	5E				
F2B6	20		FCC	"	X="^"
F2B7	20				
F2B8	58				
F2B9	3D				
F2BA	5E				
F2BB	20		FCC	"	DP="^"
F2BC	44				
F2BD	50				
F2BE	3D				
F2BF	5E				
F2C0	20		FCC	"	B="^"
F2C1	20				
F2C2	42				
F2C3	3D				
F2C4	5E				
F2C5	20		FCC	"	A="^"
F2C6	20				
F2C7	41				
F2C8	3D				
F2C9	5E				
F2CA	20		FCC	"	CC="^"
F2CB	43				
F2CC	43				
F2CD	3D				
F2CE	5E				

*
* RAM LOADER
*

F2CF 8E	F374	LODRAM	LDX	#WHICH	"UNIT?" (0=TERM=ACIA / 1=A
F2D2 17	FDAC		LBSR	PRTEXT	
F2D5 17	FDCA		LBSR	INPCHR	GET 1 CHAR RESPONSE
F2D8 81	31		CMPA	#\$31	IS IT A 1?
F2DA 27	0C		BEQ	UNIT2	
F2DC 81	30		CMPA	#\$30	IS IT A 0?
F2DE 27	0F		BEQ	UNIT1	
F2E0 17	FDB9		LBSR	ERROR	PRINT A "?"
F2E3 17	FDB2		LBSR	CRLF	& CR/LF
F2E6 20	E7		BRA	LODRAM	& ASK AGAIN
F2E8 17	FD2A	UNIT2	LBSR	UN2INI	INITIALIZE ACIA2
F2EB 86	01		LDA	#1	
F2ED 20	01		BRA	UNIST	
F2EF 4F		UNIT1	CLRA		TERMINAL IS ALRE
F2F0 97	52	UNIST	STA	UNITN	SAVE UNIT FLAG
F2F2 8D	70	LOAD1	BSR	INCH	GET A CHAR VIA SELECTED
F2F4 81	53		CMPA	#'S	
F2F6 26	FA		BNE	LOAD1	1ST GOOD CHAR IS "S"
F2F8 8D	6A		BSR	INCH	GET ANOTHER CHAR
F2FA 81	39		CMPA	#'9	"S9" => EOF
F2FC 27	25		BEQ	EOF	
F2FE 81	31		CMPA	#'1	"S1" => START OF RECORD
F300 26	F0		BNE	LOAD1	OTHERWISE MUST BE GARBAGE
F302 0F	53		CLR	CKSM	START RECORD: CLEAR CHECK
F304 8D	2D		BSR	BYTE	READ A BYTE
F306 80	02		SUBA	#2	
F308 97	54		STA	BYTCT	SAVE COUNT OF DATA BYTES
F30A 8D	1C		BSR	BADDR	BUILD RAM ADDRESS (WHERE
F30C 8D	25	LOAD11	BSR	BYTE	GET A BYTE
F30E 0A	54		DEC	BYTCT	
F310 27	04		BEQ	LOAD15	BRANCH IF WE GOT SPECIFIED
F312 A7	80		STA	0,X+	ELSE SAVE BYTE
F314 20	F6		BRA	LOAD11	& LOOP
F316 0C	53	LOAD15	INC	CKSM	GOT SPECIFIED # OF BYTES
F318 27	D8		BEQ	LOAD1	CHECKSUM O.K. GO LOOK FOR
F31A 8E	F37B		LDX	#LDERM	"CHECKSUM ERROR"
F31D 17	FD61	EXITL	LBSR	PRTEXT	
F320 16	FDFF		LBRA	DEBUG	BACK TO DEBUGGER TO ACCEP
F323 8E	F387	EOF	LDX	#LDOK	"LOAD O.K."
F326 20	F5		BRA	EXITL	EXIT LOAD

*
* RAM LOADER INPUT & UTILITY ROUTINES
*

* BADDR BUILDS A 16 BIT ADDRESS FROM THE 1ST 4 CHARS OF THE
* RECORD FOLLOWING "S1"

F328 8D	09	BADDR	BSR	BYTE	GET A HEX BYTE
F32A 97	43		STA	TMP	
F32C 8D	05		BSR	BYTE	GET ANOTHER HEX BYTE
F32E 97	44		STA	TMP+1	
F330 9E	43		LDX	TMP	RETURN WITH 16 BIT ADDR
F332 39			RTS		

*
* BYTE READS 2 CHARS & FORMATS THEM INTO THEIR BYTE VALUE
* IT ADDS IN BYTE VALUE TO THE CHECKSUM

```

*
F333 8D 15 BYTE BSR INHEX GET 1 CHAR
F335 48 ASLA
F336 48 ASLA
F337 48 ASLA
F338 48 ASLA
F339 34 02 PSHS A
F33B 8D 0D BSR INHEX GET 2ND CHAR
F33D 84 0F ANDA #$0F MASK TO LO 4 BITS
F33F AB E4 ADDA 0,S ADD IN HI 4
F341 1F 89 TFR A,B COPY BYTE TO B
F343 DB 53 ADDB CKSM ADD BYTE VALUE INTO CHEC
F345 D7 53 STB CKSM SAVE NEW CHECKSUM VALUE
F347 32 61 LEAS 1,S CLEAN UP STACK
F349 39 RTS

```

```

*
* INHEX GETS AN INPUT ASCII CHARACTER, CHECKS IT FOR VALID
* AND RETURNS IT AS BINARY CODED HEX DIGIT
*

```

```

F34A 8D 18 INHEX BSR INCH GET A CHAR
F34C 81 30 CMPA #$30
F34E 2B 0F BMI DERR <0 NOT VALID
F350 81 39 CMPA #$39
F352 2F 0A BLE INEX 0 =< CHAR =< 9 OK AS IS
F354 81 41 CMPA #$41
F356 2B 07 BMI DERR <A INVALID
F358 81 46 CMPA #$46
F35A 2E 03 BGT DERR >F INVALID
F35C 80 07 SUBA #7 BETWEEN A & F SUBTRACT
F35E 39 INEX RTS
F35F 8E F391 DERR LDX #BADD "DATA ERR"
F362 20 B9 BRA EXITL

```

```

*
* INCH GETS 1 ASCII CHAR FROM THE SELECTED UNIT
*

```

```

F364 96 52 INCH LDA UNITN IF (UNIT .EQ. 0)
F366 27 09 BEQ INCH1 THEN BRANCH
F368 96 51 INCH2 LDA CHR2 ELSE GET IT FROM ACIA2
F36A 27 FC BEQ INCH2 WAIT FOR CHAR TO BE PUT I
F36C 84 7F ANDA #$7F VIA INTERRUPT. MASK OFF
F36E 0F 51 CLR CHR2
F370 39 RTS
F371 16 FCB6 INCH1 LBRA GETCHR USE REGULAR KEYBOARD READ

```

```

*
* LOAD RAM MESSAGES
*

```

```

F374 40 WHICH FCC "@UNIT?~"
F375 55
F376 4E
F377 49
F378 54
F379 3F
F37A 5E
F37B 40 LDERM FCC "@CKSUM ERRO~"
F37C 43
F37D 4B
F37E 53
F37F 55
F380 4D

```


F381 20
 F382 45
 F383 52
 F384 52
 F385 40
 F386 5E
 F387 40
 F388 4C
 F389 44
 F38A 20
 F38B 4F
 F38C 2E
 F38D 4B
 F38E 2E
 F38F 40
 F390 5E
 F391 40
 F392 44
 F393 41
 F394 54
 F395 41
 F396 20
 F397 45
 F398 52
 F399 52
 F39A 40
 F39B 5E

LDOK FCC "GLD O.K.@~"

BADD FCC "@DATA ERR@~"

*
 * PRINT REGISTERS
 *

F39C 8E F661
 F39F 17 FCDF
 F3A2 30 62
 F3A4 17 FD63
 F3A7 16 FD76

PREGS LDX #RGTEXT
 LBSR PRTEXT
 LEAX 2,S
 LBSR PRTREG
 LBRA POPLIN

PRINT HEADING LINE

PRINT REGISTER VALUES
 RETURN VIA POPLIN

*
 * HELP: PRINT DEBUGGER COMMANDS
 *

F3AA 86 0D
 F3AC 17 FC96
 F3AF 8E F3B6
 F3B2 17 FCCC
 F3B5 39

HELP LDA #0D
 LBSR PUTCHR
 LDX #OCM
 LBSR PRTEXT
 RTS

NEW LINE BEFORE PRINTING

F3B6 2F
 F3B7 20
 F3B8 20
 F3B9 20
 F3BA 4F
 F3BB 50
 F3BC 45
 F3BD 4E
 F3BE 20
 F3BF 43
 F3C0 55
 F3C1 52
 F3C2 52
 F3C3 45
 F3C4 4E

OCM FCC "/ OPEN CURRENT LOC@"

F3C5	54
F3C6	20
F3C7	4C
F3C8	4F
F3C9	43
F3CA	40
F3CB	43
F3CC	20
F3CD	20
F3CE	20
F3CF	43
F3D0	4C
F3D1	45
F3D2	41
F3D3	52
F3D4	20
F3D5	42
F3D6	52
F3D7	45
F3D8	41
F3D9	4B
F3DA	50
F3DB	4F
F3DC	49
F3DD	4E
F3DE	54
F3DF	40
F3E0	20
F3E1	20
F3E2	20
F3E3	20
F3E4	43
F3E5	48
F3E6	41
F3E7	4E
F3E8	47
F3E9	45
F3EA	20
F3EB	4F
F3EC	50
F3ED	45
F3EE	4E
F3EF	20
F3F0	4C
F3F1	4F
F3F2	43
F3F3	20
F3F4	54
F3F5	4F
F3F6	20
F3F7	58
F3F8	58
F3F9	40
F3FA	2B
F3FB	20
F3FC	20
F3FD	20
F3FE	4F
F3FF	50

CBM

FCC

"C

CLEAR BREAKPOINT@

CMM

FCC

"

CHANGE OPEN LOC TO XX@

ONM

FCC

"+

OPEN NEXT LOC@

F400	45
F401	4E
F402	20
F403	4E
F404	45
F405	58
F406	54
F407	20
F408	4C
F409	4F
F40A	43
F40B	40
F40C	2D
F40D	20
F40E	20
F40F	20
F410	4F
F411	50
F412	45
F413	4E
F414	20
F415	50
F416	52
F417	45
F418	56
F419	49
F41A	4F
F41B	55
F41C	53
F41D	20
F41E	4C
F41F	4F
F420	43
F421	40
F422	42
F423	20
F424	20
F425	20
F426	53
F427	45
F428	54
F429	20
F42A	42
F42B	52
F42C	4B
F42D	50
F42E	54
F42F	20
F430	49
F431	4E
F432	20
F433	4F
F434	50
F435	45
F436	4E
F437	20
F438	4C
F439	4F
F43A	43

OPM

FCC

"-

OPEN PREVIOUS LOC@

SBM

FCC

"B

SET BRKPT IN OPEN LOC@

F43B	40				
F43C	47	JOM	FCC	"G	GOTO OPEN LOC@
F43D	20				
F43E	20				
F43F	20				
F440	47				
F441	4F				
F442	54				
F443	4F				
F444	20				
F445	4F				
F446	50				
F447	45				
F448	4E				
F449	20				
F44A	4C				
F44B	4F				
F44C	43				
F44D	40				
F44E	4A	JSM	FCC	"J	JSR TO OPEN LOC@
F44F	20				
F450	20				
F451	20				
F452	4A				
F453	53				
F454	52				
F455	20				
F456	54				
F457	4F				
F458	20				
F459	4F				
F45A	50				
F45B	45				
F45C	4E				
F45D	20				
F45E	4C				
F45F	4F				
F460	43				
F461	40				
F462	4C	LRM	FCC	"L	LOAD PROG/DATA INTO RAM@
F463	20				
F464	20				
F465	20				
F466	4C				
F467	4F				
F468	41				
F469	44				
F46A	20				
F46B	50				
F46C	52				
F46D	4F				
F46E	47				
F46F	2F				
F470	44				
F471	41				
F472	54				
F473	41				
F474	20				
F475	49				

F476	4E				
F477	54				
F478	4F				
F479	20				
F47A	52				
F47B	41				
F47C	4D				
F47D	40				
F47E	4F	OLM	FCC	"O	OPEN LOC XXXXG"
F47F	20				
F480	20				
F481	20				
F482	4F				
F483	50				
F484	45				
F485	4E				
F486	20				
F487	4C				
F488	4F				
F489	43				
F48A	20				
F48B	58				
F48C	58				
F48D	58				
F48E	58				
F48F	40				
F490	52	RIM	FCC	"R	RETURN FROM INTG"
F491	20				
F492	20				
F493	20				
F494	52				
F495	45				
F496	54				
F497	55				
F498	52				
F499	4E				
F49A	20				
F49B	46				
F49C	52				
F49D	4F				
F49E	4D				
F49F	20				
F4A0	49				
F4A1	4E				
F4A2	54				
F4A3	40				
F4A4	53	OSM	FCC	"S	OPEN STACK PTR LOC@"
F4A5	20				
F4A6	20				
F4A7	20				
F4A8	4F				
F4A9	50				
F4AA	45				
F4AB	4E				
F4AC	20				
F4AD	53				
F4AE	54				
F4AF	41				
F4B0	43				

F4B1	4B
F4B2	20
F4B3	50
F4B4	54
F4B5	52
F4B6	20
F4B7	4C
F4B8	4F
F4B9	43
F4BA	40
F4BB	43
F4BC	54
F4BD	4C
F4BE	2D
F4BF	53
F4C0	20
F4C1	20
F4C2	53
F4C3	45
F4C4	54
F4C5	20
F4C6	53
F4C7	54
F4C8	41
F4C9	43
F4CA	4B
F4CB	20
F4CC	50
F4CD	54
F4CE	52
F4CF	20
F4D0	54
F4D1	4F
F4D2	20
F4D3	4F
F4D4	50
F4D5	45
F4D6	4E
F4D7	20
F4D8	4C
F4D9	4F
F4DA	43
F4DB	40
F4DC	4D
F4DD	20
F4DE	20
F4DF	20
F4E0	4D
F4E1	45
F4E2	4D
F4E3	4F
F4E4	52
F4E5	59
F4E6	20
F4E7	54
F4E8	45
F4E9	53
F4EA	54
F4EB	40

SSM

FCC

"CTL-S

SET STACK PTR TO OPEN LOGG"

MTM

FCC

"M

MEMORY TESTG"

F4EC	50	PRM	FCC	"P	PRINT REGISTERS@
F4ED	20				
F4EE	20				
F4EF	20				
F4F0	50				
F4F1	52				
F4F2	49				
F4F3	4E				
F4F4	54				
F4F5	20				
F4F6	52				
F4F7	45				
F4F8	47				
F4F9	49				
F4FA	53				
F4FB	54				
F4FC	45				
F4FD	52				
F4FE	53				
F4FF	40				
F500	48	HLM	FCC	"H	HELP: PRINT DEBUGGER COMMANDS@
F501	20				
F502	20				
F503	20				
F504	48				
F505	45				
F506	4C				
F507	50				
F508	3A				
F509	20				
F50A	50				
F50B	52				
F50C	49				
F50D	4E				
F50E	54				
F50F	20				
F510	44				
F511	45				
F512	42				
F513	55				
F514	47				
F515	47				
F516	45				
F517	52				
F518	20				
F519	43				
F51A	4F				
F51B	4D				
F51C	4D				
F51D	41				
F51E	4E				
F51F	44				
F520	53				
F521	40				
F522	58	XTM	FCC	"X	EXIT DEBUGGER@~
F523	20				
F524	20				
F525	20				
F526	45				

F527	58
F528	49
F529	54
F52A	20
F52B	44
F52C	45
F52D	42
F52E	55
F52F	47
F530	47
F531	45
F532	52
F533	40
F534	5E

* END OF DEBUGGER.....

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ASCII TO BINARY CONVERSION

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*

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*

CONVERT AN ASCII NUMBER STRING TO BINARY POINTED TO
BY X TO AN UNSIGNED 16 BIT BINARY NUMBER IN A:B
EXIT WITH XREG POINTING TO NEXT POSITION AFTER
THE END OF THE STRING

F535 CC	000A	ASCDEC	LDD	#10	CONVERT ASCII TO DECIMAL
F538 20	03		BRA	ASC2	
F53A CC	0010	ASCBIN	LDD	#16	LOADS BASE 16 FOR CONVR
F53D DD	32	ASC2	STD	ARA	SAVES BASE IN BASE #
F53F 34	02		PSHS	A	PUSH A ZERO ON
F541 E6	80	NXTCHR	LDB	0,X+	GETS CHAR TO CONVERT
F543 C1	30		CMPB	#'0	TESTS FOR END-OF-STRING
F545 2D	1F		BLT	AEXIT	EXITS IF END
F547 C0	30		SUBB	#'0	FORMS B.C.D. NUMBER
F549 C1	0A		CMPB	#10	TESTS IF DECIMAL DIGIT
F54B 2D	0A		BLT	ASC3	SKIPS IF DECIMAL
F54D C1	10		CMPB	#16	TESTS FOR END OF STRING
F54F 2F	15		BLE	AEXIT	EXITS IF NOT A HEX DIGIT
F551 C0	07		SUBB	#7	FORMS A HEX B.C.D. DIGIT
F553 C1	10		CMPB	#16	TESTS FOR END-OF-STRING
F555 2C	0F		BGE	AEXIT	EXITS IF CHAR >"F"
F557 D7	45	ASC3	STB	TMP1	SAVES DIGIT FOR ADD
F559 35	04	CNVASC	PULS	B	RESTORES LO OF "NUMBER"
F55B 17	0085		LBSR	MULT	NUMBER GETS NUMBER * BASE
F55E DB	45		ADDB	TMP1	NUMBER GETS NUMBER + DIGIT
F560 89	00		ADCA	#0	
F562 34	04		PSHS	B	SAVES LO OF NUMBER
F564 20	DB		BRA	NXTCHR	GOES TO CONVRT NEXT CHAR
F566 30	1F	AEXIT	DEX		
F568 35	04		LEAX	-1,X	RESTORES "NUMBER"
F56A 39			PULS	B	RETURNS TO CALLER
			RTS		

* BINARY TO ASCII ROUTINE

* CONVERT A 16 BIT BINARY NUMBER IN A:B TO A STRING OF
 * ASCII DIGITS. THE ASCII STRING CAN BE IN ANY BASE
 * FROM 2 THROUGH 41. THE VALUE OF THE BASE IS IN ARB
 * ON ENTRY X MUST CONTAIN THE OUTPUT POINTER
 * ON EXIT X POINTS TO THE LAST DIGIT +1
 * THE NUMBER WILL BE LEFT JUSTIFIED W/ NO LEADING ZER

F56B 9F	43	BINDEC	STX	TMP	SAVE OUTPUT POINTER
F56D 8E	000A		LDX	#10	SET BASE TO DECIMAL
F570 20	0C		BRA	BINASC	
F572 9F	43	BINHEX	STX	TMP	SAVE OUTPUT POINTER
F574 8E	0010		LDX	#16	SET TO BASE 16 HEX
F577 20	05		BRA	BINASC	
F579 9F	43	BINOCT	STX	TMP	
F57B 8E	0008		LDX	#8	SET BASE TO OCTAL
F57E 9F	34	BINASC	STX	ARB	SAVE OUTPUT POINTER
			DES	SET	TOP-OF-STACK TO .
F580 32	7F		LEAS	-1,S	
		*			ALL ONES TO TELL END OF
F582 6F	E4		CLR	0,S	CHAR STRING (LAST CHAR
F584 63	E4		COM	0,S	PUT ON STACK FIRST)
F586 9E	34	BIN1	LDX	ARB	GET DIVISOR BASE
F588 9F	32		STX	ARA	
F58A 8D	77		BSR	DIVIDE	
F58C D7	45		STB	TMP1	SAVE B OF A:B
F58E D6	33		LDB	ARA+1	LOAD DIGIT REMAINDER
F590 34	04		PSHS	B	STACK DIGIT
F592 D6	45		LDB	TMP1	RESTORE B OF A:B
F594 5D			TSTB		TESTS IF QUOTIENT
F595 26	EF		BNE	BIN1	
F597 4D			TSTA		
F598 26	EC		BNE	BIN1	
F59A 9E	43	BINSTR	LDX	TMP	GET OUTPUT POINTER
F59C 35	04	BIN3	PULS	B	UNSTACK A DIGIT
F59E 5D			TSTB		CK IF END
F59F 2A	01		BPL	BIN4	BRA IF NOT
F5A1 39			RTS		EXIT ROUTINE
F5A2 C1	09	BIN4	CMPB	#9	CK IF A HEX DIGIT
F5A4 2F	02		BLE	BIN5	BRA IF NOT
F5A6 CB	07		ADDB	#7	CONVERT TO HEX DIGIT
F5A8 CB	30	BIN5	ADDB	#\$30	FORM ASCII DIGIT
F5AA E7	80	BINOUT	STB	0,X+	
F5AC 20	EE		BRA	BIN3	

* CONVERT A 16 BIT NUMBER IN A:B TO DECIMAL AND
* OUTPUT IT WITH LEADING ZEROS & RIGHT JUSTIFY

F5AE 0C 4C OUTDZ INC LZFLG TURN ON LEADING ZEROS FLAG

* CONVERT A:B TO DECIMAL & BLANK LEADING ZEROS

F5B0 8E	E836	OUTDEC	LDX	#CHRBUF	GET OUTPUT POINTER
F5B3 8D	B6		BSR	BINDEC	GO CONVERT
F5B5 6F	84		CLR	0,X	SET UP TERMINATOR
F5B7 D6	4B		LDB	NUMDIG	GET # OF DIGITS TO OUTPUT
F5B9 8E	E836		LDX	#CHRBUF	GET BUFFER POINTER BACK
F5BC A6	80	OUTD1	LDA	0,X+	GET CHAR
F5BE 27	03		BEQ	OUTD2	BRA IF A TERMINATOR
F5C0 5A			DECB		COUNT LEADING ZEROS
F5C1 26	F9		BNE	OUTD1	BRA IF NOT DONE
F5C3 5D		OUTD2	TSTB		
F5C4 27	0E		BEQ	OUTD4	
F5C6 86	30		LDA	#0	GET AN ASCII 0
F5C8 0D	4C		TST	LZFLG	CK IF LEADING ZEROS
F5CA 26	02		BNE	OUTD3	BRA IF SO
F5CC 86	20		LDA	#\$20	GET A SPACE CHAR
F5CE 17	FA74	OUTD3	LBSR	PUTCHR	OUTPUT BLANK OR 0
F5D1 5A			DECB		
F5D2 26	EF		BNE	OUTD2	
F5D4 8E	E836	OUTD4	LDX	#CHRBUF	
F5D7 A6	80	OUTD5	LDA	0,X+	GET CHAR
F5D9 27	05		BEQ	OUTDX	EXIT IF DONE
F5DB 17	FA67		LBSR	PUTCHR	OUTPUT THE CHAR
F5DE 20	F7		BRA	OUTD5	GO BACK FOR MORE
F5E0 0F	4C	OUTDX	CLR	LZFLG	
F5E2 39			RTS		

*

MULTIPLY ROUTINE

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MULTIPLY TWO 16 BIT BINARY NUMBERS TO PRODUCE A
16 BIT RESULT. THE CONTENTS OF ARA REMAIN UNCHANGED
A:B = A:B X ARA

I-----I B*ARA(LO)
+ I-----I 0 B*ARA(HI)
+ I-----I 0 A*ARA(LO)

= I-----I RESULT IN A:B

F5E3 34 26
F5E5 96 33
F5E7 3D
F5E8 ED 62
F5EA 35 02
F5EC D6 33
F5EE 3D
F5EF 1F 98

MULT

PSHS Y,D
LDA ARA+1
MUL
STD 2,S
PULS A
LDB ARA+1
MUL
TFR B,A

CREATE 2 BYTE TEMP & SAV
ARA(LO) -> A
B*ARA(LO) -> A:F
SAVE PARTIAL RESULTS
A -> A
ARA(LO) -> B
A*ARA(LO) -> A:F
LO BYTE OF PROD TO HI
BYTE OF RESULT

F5F1 5F
F5F2 E3 61
F5F4 ED 61
F5F6 35 04
F5F8 96 32
F5FA 3D
F5FB 1F 98
F5FD 5F
F5FE E3 E4
F600 32 62
F602 39

*

CLRB
ADDD 1,S
STD 1,S
PULS B
LDA ARA
MUL
TFR B,A
CLRB
ADDD 0,S
LEAS 2,S
RTS

CLEAR LO BYTE OF
ADD IN PREV PARTIAL RESU
SAVE IT
B -> B
ARA(HI) -> A
B*ARA(HI) -> A:F
LO BYTE OF PROD TO HI OF
ADD IN PREV PARTIAL RESI
CLEAN UP STACK
DONE

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*
DIVIDE ROUTINE

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*
*
*
DIVIDE A 16 BIT NUMBER IN A:B BY A 16 BIT
NUMBER IN ARA. EXIT WITH A:B = QUOTIENT AND THE
REMAINDER IN ARA. A:B = A:B/ARA

F603	34	06	DIVIDE	PSHS	B,A	LOADS DIVIDEND INTO X3,4
F605	DC	32		LDD	ARA	GET DIVISOR FROM ARA
F607	34	06		PSHS	B,A	PUT DIVISOR INTO X1,2
				DES		
F609	32	7F		LEAS	-1,S	
				TSX		
F60B	1F	41		TFR	S,X	
F60D	C6	01		LDB	#1	INITIALIZE COUNT
F60F	6D	01		TST	1,X	TEST FOR HI DIVISOR BIT
F611	2B	0B		BMI	DIV2	BRA IF YES
F613	5C		DIV1	INCB		COUNT LEADING ZER
F614	68	02		ASL	2,X	LEFT JUSTIFY X1,2
F616	69	01		ROL	1,X	
F618	2B	04		BMI	DIV2	BRA IF NO LEADING ZERO
F61A	C1	11		CMPB	#17	CK FOR ALL ZERO DIVISION
F61C	26	F5		BNE	DIV1	GO BACK IF BITS LEFT
F61E	E7	84	DIV2	STB	0,X	SET COUNTER
F620	EC	03		LDD	3,X	A:B GETS ORIGINAL DIVIDE
F622	6F	03		CLR	3,X	
F624	6F	04		CLR	4,X	
F626	A3	01	DIV3	SUBD	1,X	START OF DIVIDE LOOP
F628	24	06		BCC	DIV4	BRA IF DIVIDEND < DIVISOR
F62A	E3	01		ADDD	1,X	RESTORE DIVIDEND IN A:B
				CLC		
F62C	1C	FE		ANDCC	#\$FE	
F62E	20	02		BRA	DIV5	
			DIV4	SEC		
F630	1A	01		ORCC	#01	
F632	69	04	DIV5	ROL	4,X	
F634	69	03		ROL	3,X	
F636	64	01		LSR	1,X	SHIFT DIVISOR X1,2 RIGHT
F638	66	02		ROR	2,X	
F63A	6A	84		DEC	0,X	DECR COUNTER
F63C	26	E8		BNE	DIV3	BRA IF NOT DONE
F63E	DD	32		STD	ARA	SAVE REMAINDER IN ARA
F640	32	63		LEAS	3,S	CLEAN UP THE STACK
F642	35	06		PULS	A,B	GET QUOTIENT IN
F644	39			RTS		

*
HERE ARE ALL THE DEBUGGER MESSAGES

F645	40	RESTXT	FCC	/Q*ATA	CORP. 6809 DEBUGGER*Q~/
F646	2A				
F647	41				
F648	54				
F649	41				
F64A	20				
F64B	43				
F64C	4F				
F64D	52				

F64E	50
F64F	2E
F650	20
F651	36
F652	38
F653	30
F654	39
F655	20
F656	44
F657	45
F658	42
F659	55
F65A	47
F65B	47
F65C	45
F65D	52
F65E	2A
F65F	40
F660	5E

F661	40	RGTEXT	FCC	/@	EFHINZVC	A	B	DP	XREG	YREG	UREG	PC
F662	20											
F663	45											
F664	46											
F665	48											
F666	49											
F667	4E											
F668	5A											
F669	56											
F66A	43											
F66B	20											
F66C	41											
F66D	20											
F66E	20											
F66F	42											
F670	20											
F671	20											
F672	44											
F673	50											
F674	20											
F675	58											
F676	52											
F677	45											
F678	47											
F679	20											
F67A	59											
F67B	52											
F67C	45											
F67D	47											
F67E	20											
F67F	55											
F680	52											
F681	45											
F682	47											
F683	20											
F684	50											
F685	43											
F686	20											
F687	20											

F688	20
F689	53
F68A	50
F68B	40
F68C	20
F68D	5E

F68E	20	BKTX	FCC	"	BREAK~"
F68F	20				
F690	42				
F691	52				
F692	45				
F693	41				
F694	4B				
F695	5E				

F696	20	CLTX	FCC	"	CLEAR BREAK~"
F697	20				
F698	43				
F699	4C				
F69A	45				
F69B	41				
F69C	52				
F69D	20				
F69E	42				
F69F	52				
F6A0	45				
F6A1	41				
F6A2	4B				
F6A3	5E				

F6A4	20	SKTX	FCC	"	SET STACK~"
F6A5	20				
F6A6	53				
F6A7	45				
F6A8	54				
F6A9	20				
F6AA	53				
F6AB	54				
F6AC	41				
F6AD	43				
F6AE	4B				
F6AF	5E				

F6B0	20	OPTX	FCC	"	? INVALID COMMAND~"
F6B1	3F				
F6B2	20				
F6B3	49				
F6B4	4E				
F6B5	56				
F6B6	41				
F6B7	4C				
F6B8	49				
F6B9	44				
F6BA	20				
F6BB	43				
F6BC	4F				
F6BD	4D				
F6BE	4D				

F6BF	41
F6C0	4E
F6C1	44
F6C2	5E

* RAM MEMORY TEST GENERATES A SWI IF AN ERROR OCCURS
 * X CONTAINS THE ERROR ADDRESS & ACCA HAS THE TEST
 * PATTERN. ACCB HAS THE RAM ERROR CONTENTS

F6C3 8E	F755	MEMTST	LDX	#MEMTXT	GET TEST MESSAGE
F6C6 BD	F081		JSR	PRTEXT	
F6C9 BD	F0B3		JSR	INPNUM	GET BEG ADDRESS
F6CC DD	4D		STD	BEGADR	
F6CE 8E	F771		LDX	#EATXT	PRINT END ADR MESSAGE
F6D1 BD	F081		JSR	PRTEXT	
F6D4 BD	F0B3		JSR	INPNUM	GET ENDING ADDRESS
F6D7 C3	0001		ADDD	#1	ADD 1 FOR TEST
F6DA DD	4F		STD	ENDADR	
F6DC BD	F098		JSR	CRLF	
F6DF 9E	4F		LDX	ENDADR	GET END ADDRESS
F6E1 86	01		LDA	#1	
F6E3 34	02	MEMT1	PSHS	A	
F6E5 BD	F094		JSR	SPA	
F6E8 35	02		PULS	A	
F6EA 34	02		PSHS	A	
F6EC BD	F252		JSR	PNTBYT	OUTPUT CURRENT TEST PATTERN
F6EF 35	02		PULS	A	
			DEX		
F6F1 30	1F		LEAX	-1,X	
F6F3 A7	84	MEMT2	STA	0,X	PUT PATTERN IN CURRENT L
			DEX		
F6F5 30	1F		LEAX	-1,X	
F6F7 9C	4D		CMPX	BEGADR	CK IF DONE
F6F9 26	F8		BNE	MEMT2	BRA IF NOT
F6FB A7	84		STA	0,X	DO LAST LOCATION
F6FD E6	84	MEMT3	LDB	0,X	GET RAM CONTENTS
			CBA	MATCH	'EM
F6FF 34	04		PSHS	B	
F701 A1	E0		CMPA	,S+	
F703 27	01		BEQ	MEMT4	BRA IF OK
F705 3F			SWI		ERROR-ERROR-ERR
F706 63	84	MEMT4	COM	0,X	MARK LOCATION TESTED
			INX		
F708 30	01		LEAX	1,X	
F70A 9C	4F		CMPX	ENDADR	
F70C 26	EF		BNE	MEMT3	BRA IF NOT DONE
F70E 48			ASLA		SHIFT TEST BIT LE
F70F 24	D2		BCC	MEMT1	REPEAT UNTIL ALL BITS TEST
F711 8E	F780		LDX	#OKTXT	
F714 BD	F081		JSR	PRTEXT	PRINT "OK"
F717 9E	4D		LDX	BEGADR	GET BEGINNING ADDR.
F719 4F			CLRA		
F71A 97	47	LOOPW0	STA	TMPF	SET UP START PATTERN
F71C A7	84	LOOPW	STA	0,X	STORE N RAM
F71E 4C			INCA		
F71F 26	01		BNE	WCONT	TEST FOR TIME TO -
F721 4C			INCA		OFFSET PATTERN
		WCONT	INX	UPDATE	POINTER
F722 30	01		LEAX	1,X	
F724 9C	4F		CMPX	ENDADR	TEST FOR LAST ADDR.
F726 26	F4		BNE	LOOPW	FINISH

F728 96	47		LDA	TMPF	GET PATTERN START
F72A BD	F252		JSR	PNTBYT	OUTPUT TO CRT
F72D 9E	4D		LDX	BEGADR	GET START ADDRESS FOR READ
F72F 96	47		LDA	TMPF	GET PATTERN STARTT
F731 E6	84	LOOPR	LDB	0,X	READ RAM
			CBA	COMPARE	TO KNOWN
F733 34	04		PSHS	B	
F735 A1	E0		CMPA	,S+	
F737 26	1B		BNE	ERR	ERROR
F739 4C			INCA		UPDATE PATTERN
F73A 26	01		BNE	RCONT	CHECK IF TIME TO
F73C 4C			INCA		OFFSET
		RCONT	INX	UPDATE	POINTER
F73D 30	01		LEAX	1,X	
F73F 9C	4F		CMPX	ENDADR	TEST IT DONE
F741 26	EE		BNE	LOOPR	AGAIN
F743 0C	47		INC	TMPF	NEW START PATTERN
F745 9E	4D		LDX	BEGADR	GET START
F747 96	47		LDA	TMPF	
F749 26	D1		BNE	LOOPW	DO ANOTHER PASS
F74B 8E	F780		LDX	#OKTXT	
F74E BD	F081		JSR	PRTEXT	
F751 7E	F0AB		JMP	NEWLIN	DONE
F754 3F		ERR	SWI		

F755	40	MEMTXT	FCC	/@@MEMOR TEST@/
------	----	--------	-----	-----------------

F756	40
F757	4D
F758	45
F759	4D
F75A	4F
F75B	52
F75C	59
F75D	20
F75E	54
F75F	45
F760	53
F761	54
F762	40
F763	20
F764	20
F765	42
F766	45
F767	47
F768	20
F769	41
F76A	44
F76B	44
F76C	52
F76D	20
F76E	3D
F76F	20
F770	5E

FCC	/	BEG ADDR = ^/
-----	---	---------------

F771	40	EATXT	FCC	/@	END ADDR = ^/
F772	20				
F773	20				
F774	45				

F775	4E
F776	44
F777	20
F778	41
F779	44
F77A	44
F77B	52
F77C	20
F77D	3D
F77E	20
F77F	5E

F780	40	OKTXT	FCC	/QTEST	PASSED OKQ~/
F781	54				
F782	45				
F783	53				
F784	54				
F785	20				
F786	50				
F787	41				
F788	53				
F789	53				
F78A	45				
F78B	44				
F78C	20				
F78D	4F				
F78E	4B				
F78F	40				
F790	5E				

*

FFF6	ORG	\$FFF6
------	-----	--------

FFF6	F011	FIRQ1	FDB	FIRQA
FFF8	F00D	IRQ1	FDB	IRQ1A
FFFA	F0BB	SWI	FDB	BKENTR
FFFC	F033	NMI	FDB	SERINI
FFFE	F000	RES	FDB	RESTR

END

NUMBER OF SOURCE LINES = 1636

TOTAL ERRORS = 0 TOTAL WARNINGS = 0

```

.TITLE MTD ; MAG TAPE DIAGNOSTIC
.ENT MTD,.DCOM,ERMSG
.EXTD .CFRM,.DFRM
.NOMAC 1
.TXTM 1

```

```

;
; PATTERN PARAMETERS
;

```

```

NPAT= 5 ; # OF PATTERNS
PAT1= 155555 ; PATTERN 1
PAT2= 125252 ; PATTERN 2
PAT3= 052525 ; PATTERN 3
PAT4= 000000 ; PATTERN 4
PAT5= 177777 ; PATTERN 5

```

```

;
; MTDIO COMMANDS
;

```

```

MTRD= 0 ; READ
MTRW= 1 ; REWIND
MTRDS= 2 ; READ STATUS
MTSFW= 3 ; SPACE FORWARD
MTSBW= 4 ; SPACE BACKWARD
MTWR= 5 ; WRITE
MTWRE= 6 ; WRITE EOF
MTERS= 7 ; ERASE

```

```

;
; MAG TAPE STATUS BITS
;

```

```

SRW= 1B2 ; TAPE IS REWINDING
SILGL= 1B3 ; ILLEGAL
SEOT= 1B6 ; END OF TAPE MARK
SEOF= 1B7 ; END OF FILE MARK
SBOT= 1B8 ; BEGINNING OF TAPE MARK
SLOCK= 1B13 ; WRITE LOCK
SRDY= 1B15 ; UNIT READY

```

```

RECSZ= 256. ; RECORD SIZE
NRTRY= 10. ; # OF RETRIES
DCNT= 10. ; DELAY COUNT
LF= 12 ; CODE FOR LINE FEED
CR= 15 ; CODE FOR CARRIAGE RETURN
.CMSK= 5 ; ADDRESS OF RTOS CURRENT MASK

```

```

;
; DEFINITION OF RUN-TIME STACKS
;

```

```

CHTTO= UTMP ; CHANNEL FOR CONSOLE OUTPUT
CHLPT= CHTTO-1 ; CHANNEL FOR LINE PRINTER
PASCT= CHLPT-1 ; PASS COUNT
.EJEC

```

```

;
; MACROS TO PROVIDE CODING OF ERROR DETECTION FUNCTIONS.
; PROCEDURE FLOW FOR AN ERROR DETECTION FUNCTION:
;

```



```

; JMP <NRM> ; NORMAL RETURN
; EMSG 'MESSAGE 1'
; EMSG 'MESSAGE 2'
; EMSG 'MESSAGE N'
; ELOOP <ADR> ; OPTIONAL
; EHALT ; REQUIRED
<NRM>:
;
;
; MACRO TO SET-UP AN ERROR DETECTION FUNCTION
;
; CALL SEQUENCE:
;
; ESET TYPE
; TYPE = LOOP, FUNCTION WHICH USES 'LOOP ON ERROR' FEATURE
; TYPE = NLOOP, FUNCTION THAT DOES NOT USE 'LOOP ON ERROR'
;
; U6 IS USED FOR 'LOOP ON ERROR' FLAG;
; IF U6 = 0, FUNCTION DOES NOT USE 'LOOP ON ERROR' FEATURE
; IF U6 > 0, FUNCTION DOES USE 'LOE' AND FIRST TIME
; IF U6 < 0, FUNCTION DOES USE 'LOE' AND NOT FIRST TIME
;
LOOP= 1 ; 'LOOP ON ERROR'
NLOOP= 0 ; NOT 'LOOP ON ERROR'
;
; .MACRO ESET
; LDA 2,=1 ; GET FUNCTION TYPE
; MOVAV 2,6 ; U6 = TYPE
;
%
;
; ERROR MACRO TO LOOP ON ERROR
;
; CALL SEQUENCE:
;
; ELOOP ADDRESS
;
; .MACRO ELOOP
; LDA 1,@.DCOM ; GET SWR
; BITI 1B1,1,SZR ; IF(SKIP 'LOOP ON ERROR')
; JMP LR$ ; RETURN
; MOVUA 6,0 ; ELSE, GET 'LOOP ON ERROR' FLAG
; CMPI LOOP,0,SZR ; IF(.NOT. FIRST TIME)
; JMP LL$ ; THEN GO 'LOOP ON ERROR'
; EMSG 'LOOP-ON-ERROR'
; ADC 0,0 ; FLAG = -1
; MOVAV 0,6
LL$: JMP@ .+1 ; LOOP ON ERROR
; LR$= .
;
%
; .EJEC
;
;
; ERROR MACRO TO PRINT AN ERROR MESSAGE
;
; CALL SEQUENCE:
;
; EMSG "TEXT"<,NUMBER>
;
; .MACRO EMSG
; JMP MC$ ; GOTO PRINT MESSAGE CODE
MM$: .+1*2 ; BPNT TO MESSAGE
; .TXTN 1

```

```

.TXT      ^1      ; TEXT ITSELF
.MB$: .IFE      .ARGCT-2      ; IF NUMERIC PORTION
      .BLK      3      ; 6-BYTE BUFFER
      .ENDC
      .TXT      '<LF><CR>'      ; TERMINATE MESSAGE
ME$=.      ; END OF MESSAGE
      .TXTN      0
ML$: ME$-MS$*2      ; LENGTH OF MESSAGE
      .IFE      .ARGCT-2      ; IF NUMERIC PORTION
MA$: MB$      ; ADDRESS OF BUFFER
      .ENDC
;
MC$: STA      0,UAC0,3      ; SAVE AC'S
      STA      1,UAC1,3
      STA      2,UAC2,3
      MOVUA     6,0      ; GET 'LOOP ON ERROR' FLAG
      INC#      0,0,SNR      ; IF(FLAG = -1)
      JMP      MR$      ; THEN RETURN
      .IFE      .ARGCT-2      ; IF NUMERIC PORTION
      LDA      0,^2,3      ; GET NUMBER FROM STACK
      LDA      1,MA$      ; GET ADDRESS OF CONVERSION BUFFER
      JSRQ      .BOCT      ; CONVERT BINARY TO OCTAL
      .ENDC
      LDA      0,MM$      ; GET BPNT TO TEXT
      LDA      1,ML$      ; GT LENGTH OF MESSAGE
      JSRQ      .EMSG      ; PRINT THE MESSAGE
MR$=      ; RETURN
%
      .ZREL
.EMSG: ERMSG      ; ADDR. OF EMSG ROUTINE
      .NREL
ERMSG: STA      3,@UFP      ; SAVE RETURN ADDRESS
      LDA      3,@DCOM      ; GET SWR
      BITI     1B2,3,SNR      ; IF(PRINT OUT TO CONSOLE)
      JMP      EMLPT
      LDA      3,UFP      ; RESTORE FP
      LDA      2,CHTTO,3      ; THEN DO IT !
      .SYSTEM
      .WRS      CPU
      JMP      .+1
      .EJEC
EMLPT: LDA      3,@DCOM      ; GET SWR
      BITI     1B5,3,SNR      ; IF(PRINT OUT TO LPT)
      JMP      EMRET
      LDA      3,UFP      ; RESTORE FP
      LDA      2,CHLPT,3      ; THEN DO IT !
      .SYSTEM
      .WRS      CPU
      JMP      .+1
EMRET: LDA      3,UFP      ; RESTORE FP
      RETSR      ; RETURN SUBROUTINE
;
; ROUTINE TO CONVERT BINARY TO OCTAL ASCII
;
; CALL SEQUENCE:
;
; AC0 = BINARY NUMBER
; AC1 = ADDRESS OF 6-BYTE BUFFER FOR OCTAL
; JSRQ      .BOCT
;
; .MACRO      DIGIT
MOVUA     4,0      ; GET BINARY NUMBER
MOVZR     0,0      ; SHIFT OUT 3 BITS
MOVZR     0,0
MOVZR     0,0

```

%

•••••

; CALL SEQUENCE:

; THE MAXIMUM LENGTH OF NUMBER STRING IS 10.

$$NES =$$

```

NC$: STA 0,UAC0,3 ; SAVE AC'S
STA 1,UAC1,3
STA 2,UAC2,3
LDA 2,^1,3 ; U6 = NADDR
MOVAU 2,6
ULDA 7,=-^2 ; U7 = -NCNT
LDA 1,NM$ ; GET BPNT TO NUMBER STRING
MOVZR 1.1 ; CONVERT TO ADDRESS

```

GATA CORPORATION

```

NN$: LDAIU 0,0,6 ; GET A NUMBER
      UINC 6 ; INC NADDR
      JSRQ .BOCT ; CONVERT BINARY TO OCTAL
      MOVUA 5,1 ; RESTORE ADDRESS OF BUFFER
      ADDI 4,1 ; INC TO NEXT NUMBER BUFFER
      UINC 7 ; INC LOOP COUNT
      MOV 2,2,SZR ; CONVERT NUMBERS UNTIL DONE
      JMP NN$

      LDA 0,NM$ ; GET BPNT TO NUMBER STRING
      LDA 1,NL$ ; GET LENGTH OF NUMBER STRING
      JSRQ .EMSG ; PRINT THE NUMBER STRING

```

```

%
;
;
; .EJEC
;
;
;

```

```

; ERROR MACRO FOR 'HALT ON ERROR'
;

```

```

      .MACRO EHALT
      LDA 1,@.DCOM ; GET SWR
      BITI 1B6,1,SNR
      JMP HR$
      EMSG 'HALT-ON-ERROR<LF><CR>'
      HALT

```

```

      .NOMAC 0
HR$=
      .NOMAC 1

```

```

%
; MACRO TO WAIT FOR A KEY STROKE
;
;

```

```

; CALL SEQUENCE:
;
;

```

```

      WTKEY
      AC0 IS DESTROYED
;

```

```

      .MACRO WTKEY
      .SYSTEM ; WAIT FOR A KEY STROKE
      .GCHAR
      JMP .+1 ; ERROR RETURN (NEVER TAKEN)

```

```

%
;
;
; MACRO TO PERFORM FREE FORMAT TAPE I/O
;
;

```

```

; CALL SEQUENCE:
;
;

```

```

      MTDIO COMMAND< ,ADDRESS ,COUNT>
      <ERROR RETURN>
      <NORMAL RETURN>
      AC0= STATUS
;

```

```

      .MACRO MTDIO
      STA 1,UAC1,3 ; SAVE AC1, AC2
      STA 2,UAC2,3
      .IFE .ARGCT-3 ; IF 3 ARGUMENTS
      LDA 0,=^3 ; GET DATA COUNT
      LDA 1,=7777 ; GET 12-BIT MASK
      AND 0,1 ; MASK COUNT TO 12 BITS
      LDA 0,^2 ; GET DATA ADDRESS
      .ENDC
      LDA 2,=^1 ; GET COMMAND CODE
      JSRQ .MTIO ; PERFORM MAG TAPE I/O

```

```

%
; MACRO TO DELAY 'DCNT' MSECS

```

```

.MACRO DELAY
LDA 1,=DCNT ; GET DELAY COUNT
.SYSTM ; DELAY
.DELAY
HALT ; ERROR RETURN

```

%

```

.EJEC
; ROUTINE TO PERFORM FREE FORMAT TAPE I/O
;

```

```

; CALL SEQUENCE:
;

```

```

; AC0= DATA ADDRESS
; AC1= WORD OR RECORD COUNT
; AC2= COMMAND
; JSRQ .MTIO
; <ERROR RETURN>
; <NORMAL RETURN>
; AC0= STATUS REGISTER FOR BOTH NORMAL AND ERROR RETURN
;

```

```

.ZREL

```

```

.MTIO: MTIO

```

```

.NREL

```

```

MTIO: STA 3,GUFP ; SAVE RETURN ADDRESS
LDA 3,IOTBL ; GET ADDR. OF I/O TABLE
ADD 2,3 ; INDEX INTO TABLE WITH COMMAND
JMP @0,3 ; DISPATCH TO FUNCTION

```

```

IOTBL: .+1 ; ADDRESS OF I/O TABLE

```

```

MTIO1 ; READ
MTIO6 ; REWIND
MTIO8 ; READ STATUS
MTIO2 ; SPACE FORWARD
MTIO2 ; SPACE BACKWARD
MTIO1 ; WRITE
MTIO3 ; WRITE EOF
MTIO3 ; ERASE

```

```

MTIO1: DOB 0,MTA ; LOAD MEMORY ADDRESS COUNTER
MTIO2: NEG 1,1 ; NEGATE AND LOAD WORD COUNTER
DOC 1,MTA
MTIO3: ADDZL 2,2 ; BUILD AND ISSUE COMMAND TO MAG TAPE
MOVZL 2,2
DOAS 2,MTA

```

```

MTIO4: DELAY ; DELAY (GIVE DMON A CHANCE TO RUN)
SKPDN MTA ; WAIT FOR COMPLETION OF COMMAND
JMP MTIO4

```

```

DIA 0,MTA ; READ STATUS
MTIO5: LDA 3,UFP ; GET FRAME POINTER
STA 0,UAC0,3 ; RETURN STATUS TO CALLER
MOVL 0,0,SZC ; IF ERROR BIT SET
JMP .+4 ; THEN GO RETURN
LDA 2,UPC,3 ; UPC = UPC + 1
INC 2,2
STA 2,UPC,3

```

```

RETSR ; RETURN TO CALLER
MTIO6: ADDZL 2,2 ; BUILD AND ISSUE COMMAND
MOVZL 2,2
DOAS 2,MTA

```

```

DELAY
MTIO7: DIA 0,MTA ; WAIT FOR REWIND COMPLETE
BITI SRW,0,SZR
JMP MTIO7

```

```

JMP MTIO5 ; GO RETURN TO CALLER
MTIO8: DIA 0,MTA ; READ STATUS
JMP MTIO5 ; GO RETURN TO CALLER

```

```

.ZREL
PAT:      .          ; PATTERN TABLE
           PAT1
           PAT2
           PAT3
           PAT4
           PAT5
.BUFF:    BUFF       ; ADDRESS OF I/O BUFFER
;
.NREL
MTD:      UI         3,1000        ; INITIALIZE USER STACK
           LDA        0,CHTTO,2     ; COPY CHANNEL FOR TIO
           STA        0,CHTTO,3
           LDA        0,CHLPT,2     ; COPY CHANNEL FOR LPT
           STA        0,CHLPT,3
           INTDS      ; DISABLE INTERRUPTS
           LDA        0,=40         ; GET MAG TAPE PRIORITY MASK
           STA        0,.CMSK       ; DISABLE MAG TAPE INTERRUPTS
           INTEN      ; ENABLE INTERRUPTS
           ESET       NLOOP        ; SET NOT 'LOOP ON ERROR'
;
MSG       "MAG_ TAPE_ DIAGNOSTIC_ FOR_ 'SMART'_ CONTROLLER<12><15>"
;
SUB        0,0             ; RESET PASS COUNT
STA        0,PASCT,3
MTDRS:    LDA        2,.DCOM        ; GET ADDRESS OF COMMON BLOCK
           LDA        0,4,2         ; GET # OF SUBTESTS
           NEG        0,0           ; SET LOOP COUNT
           MOVAU      0,4           ; UAC4 = -DNTST
           LDA        0,5,2         ; GET ADDR. OF SUBTEST ENTRY POINT TABLE
           MOVAU      0,5           ; UAC5 = DSENT
MTDLP:    LDAIU      0,0,5          ; GET SUBTEST ENTRY POINT
           MOVL       0,0,SNC       ; IF(RUN FLAG IS RESET)
           JMP        MTDISK        ; SKIP SUBTEST
           MOVZR      0,0           ; MASK OFF RUN FLAG
           STA        0,MTDST       ; SET UCALL ADDRESS
           LDA        0,CHTTO,3     ; GET CHANNEL FOR CONSOLE OUTPUT
           LDA        1,CHLPT,3     ; GET CHANNEL FOR LINE PRINTER
           JSRQ       .CFRM         ; UCALL SUBTEST
MTDST:    0                ; UCALL ADDRESS
MTDSK:    UINC        5             ; INC TO NEXT SUBTEST
           UINC        4            ; INC LOOP COUNT
           MOV        2,2,SZR       ; RUN ALL SUBTESTS
           JMP        MTDLP
           LDA        0,PASCT,3     ; INC PASS COUNT
           INC        0,0
           STA        0,PASCT,3
           LDA        0,@.DCOM      ; GET SWR
           BITI       1B4,0,SNR     ; IF(.NOT. PRINT PASS COUNT)
           JMP        MTDRS         ; THEN RESTART
;
MSG       'PASS_ COUNT_ =_ ',PASCT
;
JMP        MTDRS              ; RESTART DIAGNOSTIC
.EJECT
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; COMMON BLOCK
;
DCOM:     0                ; DSWR
MTD       ; DENT
PERR      ; DERR

```



```

8. ; DNTST
STENT ; DSENT
STNAM ; DNAME
.ZREL
.DCOM: DCOM ; ADDRESS OF COMMON BLOCK
;
;
; SUBTEST ENTRY POINTS
;
.NREL
STENT: MTD01 ; LOOP BACK
      MTD02 ; VALID STATUS
      MTD03 ; BUSY/DONE
      MTD04 ; INTA
      MTD05 ; WRITE PROTECT
      MTD06 ; BOT/REWIND
      MTD07 ; EOF
      MTD08 ; RELIABILITY
;
;
; SUBTEST NAMES
;
STNAM: NAM01*2
      NAM02*2
      NAM03*2
      NAM04*2
      NAM05*2
      NAM06*2
      NAM07*2
      NAM08*2

.NOLOC 1
NAM01: .TXT 'LOOP BACK ????(CR)'
NAM02: .TXT 'VALID STATUS ????(CR)'
NAM03: .TXT 'BUSY/DONE (ERASE) ????(CR)'
NAM04: .TXT 'INTERRUPT ACKNOWLEDGE ????(CR)'
NAM05: .TXT 'WRITE PROTECT/ILLEGAL/READY ????(CR)'
NAM06: .TXT 'BOT/REWIND/SPACE BACKWARD/ILLEGAL ????(CR)'
NAM07: .TXT 'EOF/WRITE/READ ????(CR)'
NAM08: .TXT 'RELIABILITY ????(CR)'
.NOLOC 0
;
;
.EOT

```

```

; LOOP BACK TEST
;
USUBR   MTD01,2      ; ENTRY POINT, 2 TMPS
STA     0,CHTTO,3    ; SAVE CHANNELS
STA     1,CHLPT,3
ESET    NLOOP        ; SET NOT 'LOOP ON ERROR'
EMSG    'RUN_ LOOP_ BACK_ TEST'
;
NIOC    MTA          ; CLEAR MAG TAPE
LDA     2,=20        ; SET LOOP BACK MODE
DOA     2,MTA
SUB     2,2          ; WRITE ALL ZERO'S
UCALL   M1SUB
ADC     2,2          ; WRITE ALL ONE'S
UCALL   M1SUB
SUBZL   2,2          ; WRITE EACH BIT = ONE
M1LOP:  UCALL   M1SUB
MOVZL   2,2,SNC
JMP     M1LOP
;
LDA     0,@.DCOM     ; GET SWR
BITI    1B7,0,SNR    ; IF(.NOT. PRINT PASS)
JMP     M1RET        ; THEN RETURN
EMSG    'COMPLETE_ LOOP_ BACK_ TEST'
M1RET:  URET
;
; LOOP BACK SUBROUTINE
;
SDAT=   CHLPT-1      ; DATA SENT
RDAT=   SDAT-1       ; DATA RECEIVED
;
USUBR   M1SUB,4      ; ENTRY POINT, 4 TMPS
STA     0,CHTTO,3    ; SAVE CHANNELS
STA     1,CHLPT,3
STA     2,SDAT,3     ; SAVE SEND DATA
ESET    LOOP         ; SET 'LOOP ON ERROR'
;
M1SLP:  LDA     2,SDAT,3 ; RESTORE SEND DATA
DOB     2,MTA        ; SEND ON DOB
DOC     2,MTA        ; SEND ON DOC
DELAY
DIB     0,MTA        ; RECEIVE ON DIB
SNE     0,2          ; IF MATCH
JMP     M1SC        ; THEN GO RECEIVE DIC
STA     0,RDAT,3     ; PUT RECEIVE DATA ON STACK
EMSG    'DATA_ SENT_ ON_ DOB_ =_ ',SDAT
EMSG    'DATA_ RECEIVED_ ON_ DIB_ =_ ',RDAT
ELOOP   M1SLP
EHALT
;
M1SC:   LDA     2,SDAT,3 ; RESTORE SEND DATA
DIC     0,MTA        ; RECEIVE ON DIC
SNE     0,2          ; IF MATCH
JMP     M1SRT       ; THEN GO RETURN
.EJEC
STA     0,RDAT,3     ; PUT RECEIVE DATA ON STACK
EMSG    'DATA_ SENT_ ON_ DOC_ =_ ',SDAT
EMSG    'DATA_ RECEIVED_ ON_ DIC_ =_ ',RDAT
ELOOP   M1SLP
EHALT
M1SRT:  URET          ; RETURN
;
; VALID STATUS TEST
;

```

```

USUBR   MTD02,3           ; ENTRY POINT, 3 TMPS
STA     0,CHTTO,3         ; SAVE CHANNELS
STA     1,CHLPT,3
ESET    NLOOP              ; SET NOT 'LOOP ON ERROR'
EMSG    'RUN_ VALID_ STATUS_ TEST'
NIOC    MTA                 ; CLEAR MAG TAPE
ESET    LOOP                ; SET 'LOOP ON ERROR'
;
M2LOP:  DIA     0,MTA        ; READ STATUS
        LDA     1,=SBOT      ; BOT FLAG IS A "DON'T CARE"
        COM     1,1
        AND     1,0
        LDA     1,=4101      ; GET VALID STATUS
        XOR     0,1          ; TURN OFF ALL THE BITS
        MOV     1,1,SNR      ; IF(VALID STATUS)
        JMP     M2VAL        ; THEN GO RETURN
        STA     0,STAT,3     ; PUT STATUS ON STACK
        MSG     'INVALID_ STATUS_ =_ ',STAT
        ELOOP   M2LOP
        EHALT
;
M2VAL:  ESET    NLOOP        ; SET NOT 'LOOP ON ERROR'
        LDA     0,0.DCOM     ; GET SWR
        BITI    1B7,0,SNR    ; IF(.NOT. PRINT PASS)
        JMP     M2RET        ; THEN RETURN
        MSG     'COMPLETE_ VALID_ STATUS_ TEST'
M2RET:  URET
;
; BUSY/DONE (ERASE) TEST
;
USUBR   MTD03,2           ; ENTRY POINT, 2 TMPS
STA     0,CHTTO,3         ; SAVE CHANNELS
STA     1,CHLPT,3
ESET    NLOOP              ; SET NOT 'LOOP ON ERROR'
EMSG    'RUN_ BUSY/DONE_ (ERASE)_ TEST'
ESET    LOOP                ; SET 'LOOP ON ERROR'
;
M3LP1:  NIOC    MTA          ; CLEAR MAG TAPE
        SKPDN   MTA          ; IF(DONE = ZERO)
        JMP     M3B1        ; THEN GO TEST BUSY
        MSG     'NIOC_ DID_ NOT_ CLEAR_ DONE_ FLAG'
        ELOOP   M3LP1
        EHALT
        .EJEC
M3B1:  SKPBN   MTA           ; IF(BUSY = ZERO)
        JMP     M3LP2        ; THEN GO START MTA AND TEST AGAIN
        MSG     'NIOC_ DID_ NOT_ CLEAR_ BUSY_ FLAG'
        ELOOP   M3LP1
        EHALT
;
M3LP2:  LDA     0,=MTERS     ; GET ERASE COMMAND
        ADDZL   0,0          ; BUILD AND ISSUE COMMAND
        MOVZL   0,0
        DOAS    0,MTA
        SKPBZ   MTA          ; IF(BUSY = NONZERO)
        JMP     M3D1        ; GO TEST DONE = ZERO
        MSG     'DOAS_ DID_ NOT_ SET_ BUSY_ FLAG'
        ELOOP   M3LP2
        EHALT
;
M3D1:  SKPDN   MTA          ; IF(DONE = ZERO)
        JMP     M3WAT        ; THEN GO WAIT FOR 2 SEC
        MSG     'DOAS_ SET_ DONE_ FLAG'
        ELOOP   M3LP2
        EHALT

```

```

M3WAT: LDA 1,=2000. ; GET 2 SEC COUNT
        .SYSTEM ; DELAY 2 SEC
        .DELAY
        HALT ; ERROR RETURN
        SKPBN MTA ; IF(BUSY = ZERO)
        JMP M3D2 ; GO TEST DONE = NONZERO
        MSG 'ERASE_ COMPLETE_ DID_ NOT_ CLEAR_ BUSY'
        ELOOP M3LP2
        EHALT
M3D2: SKPDZ MTA ; IF(DONE = NONZERO)
        JMP M3PAS ; THEN PASS TEST
        MSG 'ERASE_ COMPLETE_ DID_ NOT_ SET_ DONE'
        ELOOP M3LP2
        EHALT
;
M3PAS: ESET NLOOP ; SET NOT 'LOOP ON ERROR'
        LDA 0,0.DCOM ; GET SWR
        BITI 1B7,0,SNR ; IF(.NOT. PRINT PASS)
        JMP M3RET ; THEN RETURN
        MSG 'COMPLETE_ BUSY/DONE_ TEST'
M3RET: URET
        .EJEC
;
; INTERRUPT ACKNOWLEDGE TEST
;
DEVCD= CHLPT-1 ; DEVICE CODE
        .EXTN .INTP ; RTOS INTERRUPT SERVICE ADDRESS
;
        USUBR MTD04,3 ; ENTRY POINT, 3 TMPs
        STA 0,CHTTO,3 ; SAVE CHANNELS
        STA 1,CHLPT,3
        ESET NLOOP ; SET NOT 'LOOP ON ERROR'
        MSG 'RUN_ INTERRUPT_ ACKNOWLEDGE_ TEST'
        INTDS ; DISABLE INTERRUPTS
        IORST ; I/O RESET
        LDA 0,=40 ; GET MAG TAPE PRIORITY MASK
        LDA 1,.CMSK ; GET RTOS CURRENT MASK
        XOR 0,1 ; OR OUT MAG TAPE MASK
        MSKO 1 ; ENABLE MAG TAPE INTERRUPTS
        JSR M4SUB ; START MTA AND RTC
        LDA 2,M4IS1 ; GET ADDRESS OF INT. SRV.
        STA 2,1,0 ; SET INTERRUPT VECTOR
        INTEN ; ENABLE INTERRUPTS
        JMP . ; WAIT FOR INTERRUPT
        JMPQ .+1 ; GO MASK OUT MTA AND TRY AGAIN
        M4MSK
;
M4SUB: SAVE ; SAVE MACHINE STATE
        LDA 2,=MTERS ; BUILD AND ISSUE ERASE COMMAND
        ADDZL 2,2
        MOVZL 2,2
        DOAS 2,MTA
        SKPDN MTA ; WAIT FOR COMPLETION OF ERASE
        JMP .-1
        NIOS RTC ; START RTC
        SKPDN RTC ; WAIT FOR FIRST TICK
        JMP .-1
        NIOS RTC ; RESTART CLOCK
        RETSR ; RETURN SUBROUTINE
;
M4IS1: .+1 ; ADDRESS OF INTERRUPT SERVICE
        LDA 2,M4RIV ; RESTORE RTOS INTERRUPT VECTOR
        STA 2,1,0
        ISZ 0,0 ; INC. INTERRUPT P.C.
        INTA 0 ; INTERRUPT ACKNOWLEDGE

```

```

CMPI      MTA,0,SNR      ; IF(MTA CAUSED INTERRUPT)
JMPQ      0,0            ; THEN SUCCESS, RETURN FROM INT. SRV
CMPI      RTC,0,SZR      ; IF(RTC CAUSED INTERRUPT)
JMP        M4ER1
INTEN                                ; THEN FAILURE, ENABLE INTERRUPTS
EMSG      'MAG_ TAPE_ DID_ NOT_ GENERATE_ INTERRUPT'
EHALT
JMP        M4RT1          ; GO RETURN FROM SUBROUTINE
.EJEC
M4RIV:    .INTP          ; RTOS INTERRUPT VECTOR

M4ER1:    INTEN          ; ELSE, FAILURE, ENABLE INTERRUPTS
STA      0,DEVCD,3      ; PUT DEVICE CODE ON STACK
EMSG      'WRONG_ "INTA" _ DEVICE_ CODE_ =_ ',DEVCD
EHALT
M4RT1:    JMP        M4RET      ; GO RETURN FROM SUBROUTINE

.M4SB:    M4SUB
M4MSK:    LDA      2,=40      ; MASK OUT MAG TAPE
MSKO      2
JSRQ      .M4SB          ; START MTA AND RTC
LDA      2,M4IS2          ; GET ADDRESS OF INTERRUPT SERVICE
STA      2,1,0          ; SET INTERRUPT VECTOR
INTEN                                ; ENABLE INTERRUPTS
JMP
JMP        M4PAS          ; GO REPORT PASS

M4IS2:    .+1            ; ADDRESS OF INT. SRV.
LDA      2,M4RIV          ; RESTORE RTOS INTERRUPT VECTOR
STA      2,1,0
ISZ      0,0            ; INC. INTERRUPT P.C.
INTA      0            ; INTERRUPT ACKNOWLEDGE
IORST                                ; I/O RESET
CMPI      MTA,0,SZR      ; IF(MTA DID NOT CAUSE INTERRUPT)
JMPQ      0,0            ; THEN SUCCESS, RETURN FROM INT. SRV.
INTEN                                ; ELSE, FAILURE, ENABLE INTERRUPTS
EMSG      'MASK_ OUT_ FAILURE'
EHALT
JMP        M4RET          ; GO RETURN FROM SUBROUTINE

M4PAS:    NIOS      RTC      ; START RTC
INTEN                                ; ENABLE INTERRUPTS
ESET      NLOOP          ; SET NOT 'LOOP ON ERROR'
LDA      0,@.DCOM        ; GET SWR
BITI      1B7,0,SNR      ; IF(.NOT. PRINT PASS)
JMP        M4RET          ; THEN RETURN
EMSG      'COMPLETE_ INTERRUPT_ ACKNOWLEDGE_ TEST'
M4RET:    URET
.EJEC

;
; WRITE PROTECT/ ILLEGAL/ READY TEST
;
MSTAT=    UAC0          ; MAG TAPE STATUS ON THE STACK
;
USUBR      MTD05,2        ; ENTRY POINT, 2 TMPS
STA      0,CHTTO,3        ; SAVE CHANNELS
STA      1,CHLPT,3
ESET      NLOOP          ; SET NOT 'LOOP ON ERROR'
EMSG      'RUN_ WRITE_ PROTECT/_ ILLEGAL/_ READY_ TEST'
;
EMSG      'REMOVE_ TAPE_ CARTRIDGE'
NIOC      MTA
DIA      0,MTA
MOVR#     0,0,SZC        ; WAIT FOR 'UNIT READY' TO
JMP        .-2

```



LDA 1,=1000.

; DELAY 1 SECOND

.SYSTEM

.DELAY

HALT

EMSG 'WRITE PROTECT TAPE AND RE-INSERT'

DIA 0,MTA

MOVR# 0,0,SNC ; WAIT FOR 'UNIT READY' TO GO HIGH

JMP -2

BITI SLOCK,0,SZR ; TEST 'WRITE PROTECT' HIGH

JMP M5WR ; PASS, GO WRITE AND TEST

EMSG 'TAPE DID NOT BECOME PROTECTED: ',MSTAT

EHALT

M5WR: MTDIO MTWR,.BUFF,4096.

JMP M5WR1 ; ERROR RETURN

EMSG 'WRITE DID NOT SET "ERROR" FLAG: ',MSTAT

EHALT

M5WR1:

.IFN 0

BITI SILGL,0,SZR ; TEST "ILLEGAL" FLAG HIGH

JMP M5WR2 ; PASS

EMSG 'WRITE DID NOT SET "ILLEGAL" FLAG: ',MSTAT

EHALT

.ENDC

.EJEC

M5WR2: MTDIO MTWRE ; WRITE EOF

JMP M5WR3 ; ERROR RETURN

EMSG 'WREOF DID NOT SET "ERROR" FLAG: ',MSTAT

EHALT

M5WR3:

.IFN 0

BITI SILGL,0,SZR ; TEST "ILLEGAL" FLAG HIGH

JMP M5ER ; PASS

EMSG 'WREOF DID NOT SET "ILLEGAL" FLAG: ',MSTAT

EHALT

.ENDC

M5ER: MTDIO MTERS ; ERASE

JMP M5ER1 ; ERROR RETURN

EMSG 'ERASE DID NOT SET "ERROR" FLAG: ',MSTAT

EHALT

M5ER1:

.IFN 0

BITI SILGL,0,SZR ; TEST "ILLEGAL" FLAG HIGH

JMP M5PAS ; PASS

EMSG 'ERASE DID NOT SET "ILLEGAL" FLAG: ',MSTAT

EHALT

.ENDC

M5PAS: EMSG 'REMOVE TAPE CARTRIDGE'

DIA 0,MTA

MOVR# 0,0,SZC ; WAIT FOR 'UNIT READY' TO GO LOW

JMP -2

EMSG 'WRITE ENABLE TAPE AND RE-INSERT'

DIA 0,MTA

MOVR# 0,0,SNC ; WAIT FOR 'UNIT READY' TO GO HIGH

JMP -2

ESET NLOOP ; SET NOT 'LOOP ON ERROR'

LDA 0.Q.DCOM ; GET SWR


```

        JMP      M5RET      ; THEN RETURN
        MSG      'COMPLETE_ WRITE_ PROTECT/_ ILLEGAL/_ READY_ TEST'
M5RET:   URET
        .EJEC
;
; BOT/ REWIND/ SPACE BACKWARD/ ILLEGAL TEST
;
        USUBR     MTD06,2      ; ENTRY POINT, 2 TMPs
        STA      0,CHTTO,3      ; SAVE CHANNELS
        STA      1,CHLPT,3
        ESET      NLOOP          ; SET NOT 'LOOP ON ERROR'
        MSG      'RUN_ BOT/_ REWIND/_ SPACE_ BACKWARD/_ ILLEGAL_ TEST'
;
        MSG      'REMOVE_ TAPE_ CARTRIDGE'
        NIOC      MTA
        DIA      0,MTA
        MOVR#     0,0,SZC          ; WAIT FOR 'UNIT READY' TO GO LOW
        JMP      -2
        LDA      1,=1000.          ; DELAY FOR 1 SECOND
        .SYSTEM
        .DELAY
        HALT
        MSG      'WRITE_ ENABLE_ TAPE_ AND_ RE-INSERT'
        DIA      0,MTA
        MOVR#     0,0,SNC          ; WAIT FOR 'UNIT READY' TO GO HIGH
        JMP      -2
;
        LDA      2,=2              ; SET LOOP COUNT
        NEG      2,2
        MOVAU     2,4              ; USE U4
M6LOP:   MTDIO     MTERS          ; ERASE TO MOVE OFF BOT
        HALT          ; ERROR RETURN
        UINC      4              ; INC LOOP COUNT
        MOV      2,2,SZR          ; LOOP UNTIL DONE
        JMP      M6LOP
;
        BITI      SBOT,0,SNR        ; TEST "BOT" FLAG LOW
        JMP      M6TRW          ; PASS, GO TEST "REWINDING"
        MSG      'ERASE_ DID_ NOT_ RESET_ "BOT" FLAG:_ ',MSTAT
        EHALT
;
M6TRW:   BITI      SRW,0,SNR        ; TEST "REWINDING" FLAG LOW
        JMP      M6RW          ; PASS, GO REWIND
        MSG      '"REWINDING" FLAG_ IS_ SET_ BEFORE_ COMMAND:_ ',MSTAT
        EHALT
;
M6RW:    LDA      0,=MTRW          ; GET REWIND COMMAND
        ADDZL     0,0              ; BUILD AND ISSUE COMMAND
        MOVZL     0,0
        DOAS      0,MTA
        DELAY          ; WAIT FOR 'SMART' CONTROLLER
        DIA      0,MTA          ; GET MAG TAPE STATUS
        BITI      SRW,0,SZR        ; TEST "REWINDING" FLAG HIGH
        JMP      M6WT          ; PASS, GO WAIT FOR COMPLETION
        MSG      'REWIND_ COMMAND_ DID_ NOT_ SET_ "REWINDING" FLAG:_ ',MSTAT
        EHALT
        .EJEC
;
M6WT:    LDA      1,=2000.          ; DELAY 2 SECONDS
        .SYSTEM
        .DELAY
        HALT
        DIA      0,MTA          ; GET MAG TAPE STATUS
        BITI      SRW,0,SNR        ; TEST "REWINDING" FLAG LOW
        JMP      M6TBT          ; PASS, GO TEST "BOT"

```



EHALT

```

;
M6TBT:  BITI    SBOT,0,SZR      ; TEST "BOT" FLAG HIGH
        JMP     M6SBW          ; PASS, GO SPACE BACKWARD
        MSG     'REWIND_ DONE_ DID_ NOT_ SET_ "BOT" FLAG:_ ',MSTAT
        EHALL

;
M6SBW:  MTDIO   MTSBW,.BUFF,1   ; SPACE BACKWARD 1 RECORD
        JMP     M6ER1          ; ERROR RETURN
        MSG     'SPACE_ BW_ DID_ NOT_ SET_ "ERROR" FLAG:_ ',MSTAT
        EHALL

;
M6ER1:  BITI    SILGL,0,SZR     ; TEST "ILLEGAL" FLAG HIGH
        JMP     M6PAS          ; PASS
        MSG     'SPACE_ BW_ DID_ NOT_ SET_ "ILLEGAL" FLAG:_ ',MSTAT
        EHALL

;
M6PAS:  ESET     NLOOP          ; SET NOT 'LOOP ON ERROR'
        LDA     0,Q.DCOM       ; GET SWR
        BITI    1B7,0,SNR      ; IF(.NOT. PRINT PASS)
        JMP     M6RET          ; THEN RETURN
        MSG     'COMPLETE_ BOT/_ REWIND/_ SPACE_ BACKWARD/_ ILLEGAL_ TEST'
M6RET:  URET     .EJEC

```

```

;
; EOF TEST
;
        USUBR   MTD07,2        ; ENTRY POINT, 2 TMPS
        STA     0,CHTTO,3      ; SAVE CHANNELS
        STA     1,CHLPT,3
        ESET     NLOOP          ; SET NOT 'LOOP ON ERROR'
        MSG     'RUN_ EOF_ TEST'

        NIOC     MTA
        MTDIO    MTWRE          ; WRITE EOF
        NOP      ; ERROR RETURN
        BITI     SEOF,0,SZR     ; TEST "EOF" BIT HIGH
        JMP      M7ERS          ; PASS
        MSG     'WREOF_ DID_ NOT_ SET_ "EOR" FLAG:_ ',MSTAT
        EHALL

```

```

M7ERS:  MTDIO    MTERS          ; ERASE
        NOP      ; ERROR RETURN
        BITI     SEOF,0,SNR     ; TEST "EOF" BIT LOW
        JMP      M7PAS          ; PASS
        MSG     'ERASE_ DID_ NOT_ RESET_ "EOF" FLAG'
        EHALL

```

```

;
M7PAS:  ESET     NLOOP          ; SET NOT 'LOOP ON ERROR'
        LDA     0,Q.DCOM       ; GET SWR
        BITI    1B7,0,SNR      ; IF(.NOT. PRINT PASS)
        JMP     M7RET          ; THEN RETURN
        MSG     'COMPLETE_ EOF_ TEST'
M7RET:  URET     .EJEC

```

```

;
; RELIABILITY TEST
;

```

```

FILCT=  CHLPT-1                ; FILE COUNT (1ST WORD OF EACH RECORD)
EFILE=  0                      ; ERROR SUMMARY FILE #
ERTRY=  1                      ; ERROR SUMMARY RETRIES
EPAT=   2                      ; ERROR SUMMARY PATTERN
ESTAT=  3                      ; ERROR SUMMARY STATUS
ESLEN=  4                      ; ERROR SUMMARY LENGTH

```

```

NREC: 0 ; TOTAL # OF RECORDS
NWERP: 0 ; # OF WRITE ERRORS WITH PASS AFTER RETRIES
NWERF: 0 ; # OF WRITE ERRORS WITH FAIL AFTER RETRIES
NRERP: 0 ; # OF READ ERRORS WITH PASS AFTER RETRIES
NRERF: 0 ; # OF READ ERRORS WITH FAIL AFTER RETRIES
SBGN: SBUF ; BEGINNING OF SUMMARY BUFFER
SEND: SBUF ; END OF SUMMARY BUFFER
SPNT: 0 ; POINTER INTO SUMMARY BUFFER

```

```

.NREL
USUBR MTD08,3 ; ENTRY POINT, 3 TMPS
STA 0,CHTTO,3 ; SAVE CHANNELS
STA 1,CHLPT,3
ESET NLOOP ; SET NOT 'LOOP ON ERROR'
EMSG 'RUN_ RELIABILITY_ TEST'
NIOC MTA
MTDIO MTRW ; REWIND MAG TAPE
HALT ; ERROR RETURN
LDA 0,CHTTO,3 ; RESTORE CHANNEL
LDA 2,SBGN ; SET ERROR SUMMARY POINTER
STA 2,SPNT
SUB 2,2 ; RESET ERROR COUNTS
STA 2,NREC ; # OF RECORDS
STA 2,NWERP ; # OF WRITE ERRORS (PASS)
STA 2,NWERF ; # OF WRITE ERRORS (FAIL)
STA 2,NRERP ; # OF READ ERRORS (PASS)
STA 2,NRERF ; # OF READ ERRORS (FAIL)
STA 2,FILCT,3 ; FILE COUNT = 0

```

```

M8LOP: UCALL WRPAT ; WRITE PATTERN FILE
MTDIO MTSBW,..BUFF,0 ; SPACE BACKWARD 1 FILE
NOP ; ERROR RETURN
BITI SBOT,0,SZR ; IF(BOT)
JMP M8RDP ; THEN GO READ PATTERN FILE
MTDIO MTSFW,..BUFF,1 ; ELSE SPACE FORWARD 1 RECORD
NOP ; ERROR RETURN
M8RDP: LDA 0,CHTTO,3 ; RESTORE CHANNEL
LDA 2,FILCT,3 ; RESTORE FILE COUNT
UCALL RDPAT ; READ PATTERN FILE
INC 2,2 ; INC. FILE COUNT
STA 2,FILCT,3
JMP M8LOP ; CONTINUOUS LOOP

```

```

;
; CONTINUOUS LOOP: MUST BE ABORTED VIA "^R" OR "^O".
.EJEC

```

```

; SUBROUTINE TO WRITE PATTERN FILE

```

```

CPAT= FILCT-1 ; CURRENT PATTERN (1-5)
ERRCT= CPAT-1 ; ERROR COUNT

```

```

USUBR WRPAT,5 ; ENTRY POINT, 5 TMPS
STA 0,CHTTO,3 ; SAVE CHANNELS
STA 1,CHLPT,3
STA 2,FILCT,3 ; SAVE FILE COUNT
SUBZL 0,0 ; CPAT = 1
STA 0,CPAT,3

```

```

WRPLP: LDA 2,PAT ; GET ADDRESS OF PATTERN TABLE
LDA 0,CPAT,3 ; GET CURRENT PATTERN #
ADD 0,2 ; INDEX INTO TABLE
LDA 0,0,2 ; GET PATTERN
LDA 2,..BUFF ; GET ADDRESS OF BUFFER
LDA 1,FILCT,3 ; SET HEADER WORD IN BUFFER
STA 1.0.2

```

```

WRPFL:  INC      2,2          ; FILL BUFFER WITH PATTERN
        STA      0,0,2
        INC      1,1, SZR
        JMP      WRPFL

WRP:    MTDIO     MTWR,.BUFF,RECSZ
        JMP      .+2          ; ERROR RETURN
        JMP      WRPSC        ; SUCCESS RETURN
        ISZ      NWERP        ; INC # OF ERROR WITH PASS
        SUB      2,2          ; ERROR COUNT = 0
        STA      2,ERRCT,3

WRTRY:  MTDIO     MTSBW,.BUFF,1 ; SPACE BACKWARD 1 RECORD
        HALT      ; ERROR RETURN
        MTDIO     MTWR,.BUFF,RECSZ
        JMP      .+2          ; ERROR RETURN
        JMP      WRPUD        ; SUCCESS RETURN
        LDA      2,ERRCT,3    ; IF ERROR COUNT = 0
        MOV      2,2, SZR
        JMP      WRP1
        LDA      2,SPNT        ; THEN UPDATE ERROR SUMMARY DATA
        STA      0,ESTAT,2
        LDA      0,FILCT,3
        STA      0,EFILE,2
        LDA      0,CPAT,3
        LDA      3,PAT          ; GET CURRENT PATTERN #
        ADD      0,3            ; GET ADDRESS OF PATTERN TABLE
        LDA      0,0,3          ; INDEX INTO TABLE
        LDA      3,UFP          ; GET PATTERN
        STA      0,EPAT,2       ; RESTORE FP
WRP1:   ISZ      ERRCT,3        ; INC ERROR COUNT
        LDA      1,ERRCT,3     ; GET ERROR COUNT
        LDA      2,=NRTRY      ; IF(ERRCT .LE. NRTRY)
        USGT      1,2
        JMP      WRTRY         ; THEN LOOP
        .EJEC
        DSZ      NWERP         ; DEC # OF WRITE ERRORS WITH PASS
        JMP      .+1           ; JUST IN CASE
        ISZ      NWERF         ; INC # OF WRITE ERRORS WITH FAIL
        LDA      2,SPNT        ; GET POINTER INTO SUMMARY BUFFER
        LDA      0,ERRCT,3     ; UPDATE # OF RETRIES
        NEG      0,0           ; SPECIFY WRITE
        STA      0,ERTRY,2
        LDA      0,SEND        ; IF(SPNT .LT. SEND)
        USLT      2,0
        JMP      WRPBE
        LDA      0,=4          ; THEN SPNT = SPNT + 4
        ADD      0,2
        STA      2,SPNT

WRPBE:  MTDIO     MTSBW,.BUFF,1 ; SPACE BACKWARD 1 RECORD
        HALT      ; ERROR RETURN
        MTDIO     MTERS        ; ERASE BAD TAPE
        HALT
        JMP      WRP          ; TRY AGAIN

WRPUD:  LDA      2,SPNT        ; GET POINTER INTO SUMMARY BUFFER
        LDA      0,ERRCT,3     ; UPDATE # OF RETRIES
        NEG      0,0           ; SPECIFY WRITE
        STA      0,ERTRY,2
        LDA      0,SEND        ; IF(SPNT .LT. SEND)
        USLT      2,0
        JMP      WRPSC
        LDA      0,=4          ; THEN SPNT = SPNT + 4
        ADD      0,2
        STA      2,SPNT

```

```

WRPSC:  ISZ      NREC      ; INC. # OF RECORDS
        ISZ      CPAT,3    ; INC. CURRENT PATTERN #
        LDA      0,CPAT,3
        LDA      1,=NPAT   ; IF(CPAT .LE. NPAT)
        USGT     0,1
        JMP      WRPLP     ; THEN LOOP

        MTDIO    MTWRE     ; WRITE EOF
        NOP
        MTDIO    MTWRE     ; WRITE EOF
        NOP
        MTDIO    MTSBW,..BUFF,0 ; SPACE BACKWARD 1 EOF
        NOP
        MTDIO    MTSBW,..BUFF,0 ; SPACE BACKWARD ANOTHER EOF
        NOP
        URET
        .EJEC             ; RETURN

```

```

;
; SUBROUTINE TO READ A PATTERN FILE
;

```

```

RDFLG=  ERRCT-1          ; ERROR FLAG
RIGHT=  RDFLG-1          ; RIGHT MATCH
WRONG=  RIGHT-1          ; WRONG MATCH

```

```

        USUBR    RDPAT,8.  ; ENTRY POINT, 8. TMPS
        STA      0,CHTTO,3 ; SAVE CHANNELS
        STA      1,CHLPT,3
        STA      2,FILCT,3 ; SAVE FILE COUNT
        SUBZL    0,0       ; CPAT = 1
        STA      0,CPAT,3

```

```

RDPLP:  SUB      0,0       ; RESET READ FLAG
        STA      0,RDFLG,3

```

```

RDFAL:  MTDIO    MTRD,..BUFF,RECSZ
        JMP      .+2       ; ERROR RETURN
        JMP      RDPSC     ; SUCCESS RETURN
        ISZ      NRERP     ; INC. # OF READ ERROR WITH PASS
        SUB      2,2       ; ERRCT = 0
        STA      2,ERRCT,3

```

```

RDTRY:  MTDIO    MTSBW,..BUFF,1 ; SPACE BACKWARD 1 RECORD
        HALT     ; ERROR RETURN
        MTDIO    MTRD,..BUFF,RECSZ
        JMP      .+2       ; ERROR RETURN
        JMP      RDPUD     ; SUCCESS RETURN
        LDA      2,ERRCT,3 ; IF (ERROR COUNT = 0)
        MOV      2,2,SZR
        JMP      RDP1
        LDA      2,SPNT    ; THEN UPDATE ERROR SUMMARY DATA
        STA      0,ESTAT,2
        LDA      0,FILCT,3
        STA      0,EFILE,2
        LDA      0,CPAT,3 ; GET CURRENT PATTERN #
        LDA      3,PAT     ; GET ADDRESS OF PATTERN TABLE
        ADD      0,3       ; INDEX INTO TABLE
        LDA      0,0,3     ; GET PATTERN
        LDA      3,UFP     ; RESTORE FP
        STA      0,EPAT,2

```

```

RDP1:  ISZ      ERRCT,3    ; INC ERROR COUNT
        LDA      1,ERRCT,3
        LDA      2,=NRTRY ; IF(ERRCT .LE. NRTRY)
        USGT     1,2
        JMP      RDTRY    ; THEN RETRY READ
        DSZ      NRERP    ; DEC # OF READ ERRORS WITH PASS
        JMP      .+1      ; JUST IN CASE

```



```

JMP      @.+1          ; GIVE-UP
RDPRT
.EJEC
RDPUD:   LDA      2,SPNT      ; GET POINTER INTO SUMMARY DATA
        LDA      0,ERRCT,3   ; UPDATE ERROR COUNT
        STA      0,ERTRY,2
        LDA      0,SEND      ; IF(SPNT .LT. SEND)
        USLT     2,0
        JMP      RDPSC
        LDA      0,=4        ; THEN SPNT = SPNT + 4
        ADD      0,2
        STA      2,SPNT

RDPSC:   LDA      2,.BUFF     ; GET ADDRESS OF BUFFER
        LDA      0,0,2       ; GET HEADER WORD
        LDA      1,FILCT,3   ; IF(FILE COUNT DON'T MATCH)
        SNE      0,1
        JMP      RDP2
        STA      0,WRONG,3    ; THEN SAVE RIGHT AND WRONG
        STA      1,RIGHT,3   ; AND PRINT MESSAGE
        MSG      "FILE COUNT DON'T MATCH"
        MSG      "SUPPOSE TO BE ",RIGHT
        MSG      "BUT IT'S ",WRONG

RDP2:    LDA      0,CPAT,3    ; FILE COUNT DOES MATCH
        LDA      3,PAT       ; GET CURRENT PATTERN #
        ADD      0,3         ; GET ADDRESS OF PATTERN TABLE
        LDA      0,0,3       ; INDEX INTO TABLE
        LDA      3,=-RECSZ+1 ; GET PATTERN
        LDA      3,=-RECSZ+1 ; SET LOOP COUNT
        RDTST: INC      2,2,SKP ; TEST FOR PATTERN MATCH
        .RDER: RDPER
        LDA      1,0,2       ; IF(PATTERN DON'T MATCH)
        SEQ      0,1
        JMP      @.RDER      ; THEN ERROR
        INC      3,3,SZR     ; TEST THE WHOLE RECORD
        JMP      RDTST

        ; PATTERN DOES MATCH
        LDA      3,UFP       ; RESTORE FP
        LDA      0,RDFLG,3   ; IF(READ FLAG = 0)
        MOV      0,0,SNR
        JMP      .RDNX      ; THEN GO READ NEXT RECORD
        MSG      "READ ERROR - THE 1 RETRY PASSED"
        MSG      "PATTERN DIDN'T MATCH ON 1ST READ OF FILE ",FILCT
        MSG      "SUPPOSE TO BE ",RIGHT
        MSG      "BUT IT WAS ",WRONG

.RDNX:   JMP      @.+1
        RDNXT
        .EJEC
RDPER:   LDA      3,UFP       ; RESTORE FP
        STA      0,RIGHT,3   ; SAVE RIGHT AND WRONG
        STA      1,WRONG,3
        LDA      0,RDFLG,3   ; IF(READ FLAG = 0)
        MOV      0,0,SZR
        JMP      RDP3
        COM      0,0        ; THEN SET READ FLAG
        STA      0,RDFLG,3
        MTDIO    MTSBW,.BUFF,1 ; SPACE BACKWARD 1 RECORD
        HALT     ; ERROR RETURN
        JMP      @.+1      ; READ FAIL -- RETRY ONCE
        RDFAL

        ; FAILED THE ONE RETRY
RDP3:    MSG      "WRITE ERROR - THE 1 RETRY FAILED AGAIN"
        MSG      "PATTERN DON'T MATCH ON FILE ",FILCT
        MSG      "SUPPOSE TO BE ",RIGHT
        MSG      "BUT IT'S ",WRONG

```


RDNXT: ISZ CPAT,3 ; INC. CURRENT PATTERN #

LDA 0,CPAT,3

LDA 1,=NPAT ; IF(CPAT .LE. NPAT)

USGT 0,1

JMPQ .RDLP ; THEN LOOP

RDPR: MTDIO MTSFW,.BUFF,0 ; SPACE FORWARD TO EOF

NOP

URET ; RETURN

.RDLP: RDPLP

.EJEC

;

; ROUTINE TO PRINT AN ERROR SUMMARY

;

PNT= CHLPT-1 ; POINTER INTO STAT BUFFER

USUBR PERR,3 ; ENTRY POINT, 3 TMPS

STA 0,CHTTO,3 ; SAVE CHANNELS

STA 1,CHLPT,3

EMSG 'ERROR SUMMARY:'

EMSG 'FILE # _ _ RETRIES PATTERN STATUS'

LDA 0,SBGN ; SET PNT = SBGN

STA 0,PNT,3

PELOP: ENUM PNT,ESLEN ; PRINT NUMBER STRING

LDA 0,PNT,3 ; PNT = PNT + 4

ADDI 4,0

STA 0,PNT,3

LDA 1,SPNT ; IF(PNT < SPNT)

USGE 0,1

JMP PELOP ; THEN LOOP

URET

;

; ROUTINE TO PRINT A STATISTICAL SUMMARY

;

TMP= CHLPT-1 ; TEMP ON STACK

USUBR PSTAT,3 ; ENTRY POINT, 3 TMPS

STA 0,CHTTO,3 ; SAVE CHANNELS

STA 1,CHLPT,3

EMSG 'STATISTICAL SUMMARY:'

LDA 0,NREC ; PUT # OF RECORDS ON STACK

STA 0,TMP,3

EMSG "TOTAL #_ OF_ RECORDS_ = ",TMP

LDA 0,NWERP ; PUT # OF SOFT WRITE ERRS ON STACK

STA 0,TMP,3

EMSG "#_ OF_ SOFT_ WRITE_ FAILURES_ = ",TMP

LDA 0,NWERF ; PUT # OF HARD WRITE ERRS ON STACK

STA 0,TMP,3

EMSG "#_ OF_ HARD_ WRITE_ FAILURES_ = ",TMP

LDA 0,NRERP ; PUT # OF SOFT READ ERRS ON STACK

STA 0,TMP,3

EMSG "#_ OF_ SOFT_ READ_ FAILURES_ = ",TMP

LDA 0,NRERF ; PUT # OF HARD READ ERRS ON STACK

STA 0,TMP,3

EMSG "#_ OF_ HARD_ READ_ FAILURES_ = ",TMP

URET

;

;;

;

SBUFB: .BLK 512. ; SUMMARY BUFFER - BEGIN (128 ERRORS)

SBUFE: .BLK 4 ; SUMMARY BUFFER - END (1 ERROR)

BUFF: .BLK 4096. ; I/O BUFFER

;

.EXTN .RTOS
.LOC 73777
.RTOS

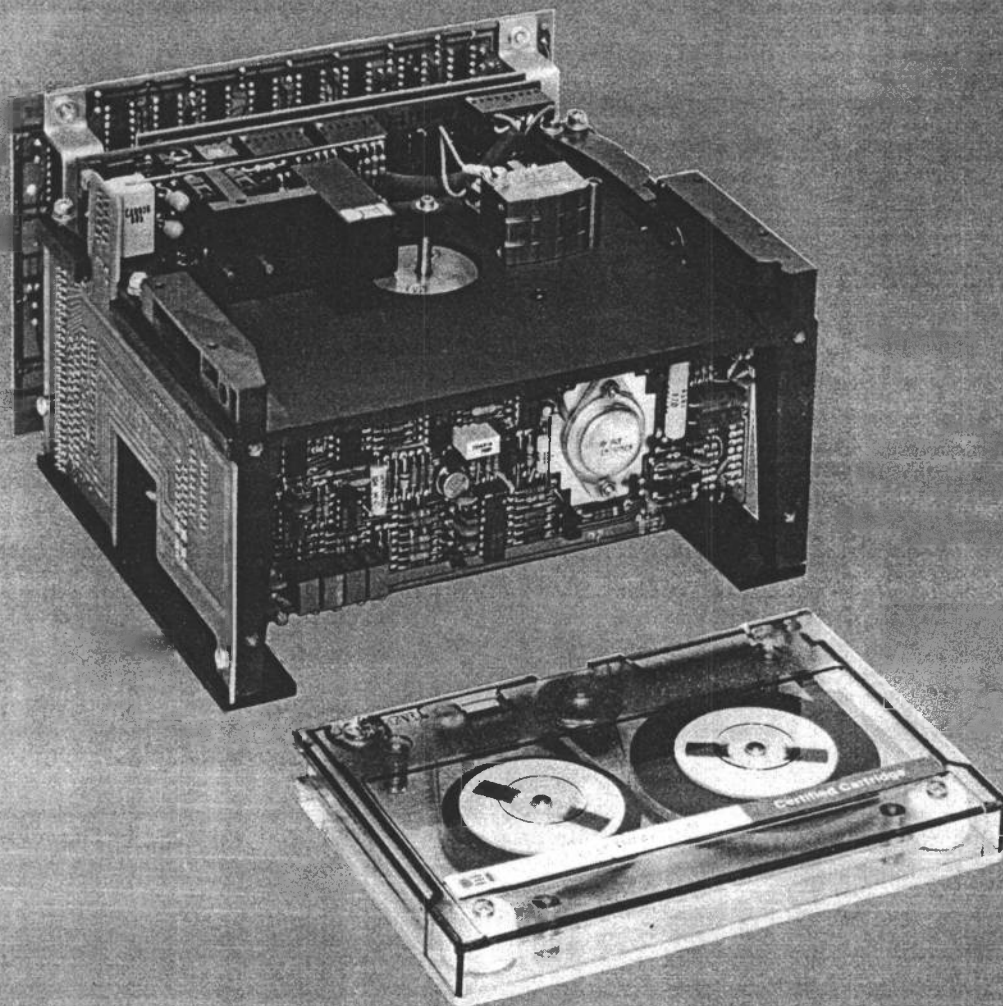
; STARTING ADDRESS FOR DBOOT

.END

THE FUNNEL

SERIES 3400

HIGH DENSITY CARTRIDGE MAGNETIC TAPE DRIVES



DEI DATA
ELECTRONICS
INC.

**FIRST IN
CARTRIDGE TAPE DRIVES**

GENERAL DESCRIPTION

The Funnel is the cartridge magnetic tape drive which has been most frequently selected by system designers to back-up small fixed disk systems. The drive has the capability of a full tape peripheral with file search, track select, and the capacity to change or add to existing records. A high duty cycle motor with continuous start-stop capability enables the Funnel to construct and read files with standard ANSI interblock gaps at 30 ips and locate and read these files at either 30 or 90 ips in both the forward and reverse directions. Up to 17.3 megabytes of data can be stored on 4 tracks.

With over 20,000 high density drives in service, the reliability of this product has been proven world wide.

Standard features of the Funnel include an integral tape cleaner which greatly enhances error free performance. A patented center-of-gravity mounting of the capstan motor allows the drive to be

mounted in any position or attitude. A proprietary dual gap head provides for read-while-write data verification and has a separate erase to assure maximum data reliability.

Up to 8 drives can be connected together on a common buss. A codec card provides data encoding of Binary (data and strobe) to a self clocking MFM code and decoding MFM to Binary (data and strobe).

ANSI standard media is available from multiple industry sources and controllers are available from a growing number of independent companies. Among the interfaces available are: μ Nova, Nova, Q Bus, S100, Multibus, LSI 11, Unibus, and RS-232. Modular power supplies are also available from multiple sources. For more information on media, controllers or power supplies, contact your local DEI Field Office or Representative.

OPTIONS AVAILABLE

Control Card

Common Bussing $\leq$ 8 Drives
Customer Selectable Unit Logic Address
Forward Motion Prevented at EOT
Reverse Motion Prevented at BOT
High Speed Allowed only between LP and EW
Automatic Positioning to BOT on:
Cartridge Insertion, Power On, Rewind
High Level Status Signals:
Busy, Ready, Flag, Selected, Write
Enable, Load Point Sensed, Early
Warning Sensed

Codec Card

Data Separation
Binary (Data and Strobe) to MFM
MFM to Binary (Data and Strobe)

SPECIFICATIONS

Cartridge:	ANSI X 3.55—1977 (450')	MTBF:	$\geq$ 3000 hours
Recording Density:	6400 bpi (2520 bpcm), MFM or other High Density Codes	MTTR:	$\leq$ 30 minutes
Recording Mode:	4 Track Serial	Data Reliability:	Less than 1 Error in 10^{10} Bits
Head Type:	Dual Gap, Read-While-Write with Separate Erase	Voltage Requirements:	+5 Vdc ($\leq$ 1.5 amps) $\pm$ 24 Vdc ($\leq$ 1.5 amps)
Tape Cleaner:	Integral	Interface Logic:	TTL Low True
Operating Speeds:	30 ips (76 cmps) Write, Bidirectional Read 90 ips (228.6 cmps) Bidirectional Search and Rewind	Weight:	4.2 lb. (1.9 kg)
Transfer Rate:	192 kbits/sec (24 kbytes/sec)	Dimensions:	4.25" x 6.96" x 7.75" (10.80 cm x 17.68 cm x 19.69 cm)
Start/Stop Time:	At 30 ips (76 cmps): 25/26 msec At 90 ips (228.6 cmps): 71/74 msec	Temperature:	+ 5°C to + 45°C Operating - 30°C to + 60°C Storage
		Relative Humidity:	20% to 80% Non-Condensing

For more detailed information on the Funnel, request Product Specification 301056

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Local Sales Representative:



For hostile environments, request information on DEI R Series Ruggedized Drives

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RECEIVED MAR 21 1980

Title: Streaming Cartridge Magnetic Tape Drive

This application note describes the architecture of the drive, the data format on tape, and the parameters within which the system must operate to maintain streaming.

General:

Streaming Cartridge Magnetic Tape Drives combine the advantages of maximum tape utilization, high transfer rate, minimum installed cost, and minimum cost per bit. These advantages are achieved by eliminating interblock gaps and writing or reading the tape in an uninterrupted mode.

Reason for Interblock Gaps:

Magnetic tape is an imperfect media. The imperfections in its magnetic surface cause loss of data in the area bounded by the imperfection and, for most serial self-clocked codes (P.E., M.F.M., etc.), in all subsequent data until resynchronization is established. To limit this loss, data is recorded on tape in finite blocks, with each block preceded by a synchronization character. Between each block a sufficient length of tape (interblock gap) is provided to allow the drive to stop and get back up to speed both in the forward and reverse directions. This stopping and starting within the interblock gaps facilitates the rewriting of marginally recorded data, block transfers to/from host system, external file structuring, and editing. The ANSI Standard length of this interblock gap for $\frac{1}{4}$ inch cartridges is ≥ 1.2 inches (typical value is 1.33 inches, refer to Figure 1).

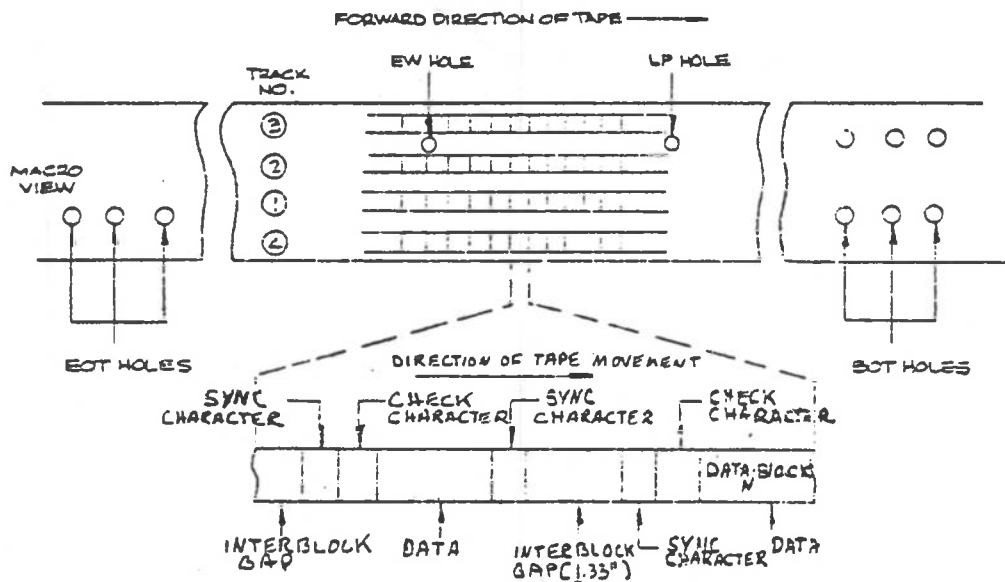


FIGURE 1. MACRO AND MICRO VIEWS OF TRACK FORMAT FOR FUNNEL



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The problem is that when recording high density data the amount of tape used for the interblock gap is disproportionate to the amount of tape used for data. As an example, a 256 byte, 6400 BPI data block has a tape utilization efficiency of 20% (.335 inches of data in 1.665 inches of space). This utilization reduces the formatted capacity of a 17.4 megabyte cartridge to only 3.5 megabytes. The currently recommended maximum block size is 4096 bytes which results in a tape utilization of 79% and yields a formatted cartridge capacity of 13.8 megabytes. (This limitation is based on the requirement for interblock resynchronization.) In designing a Streaming Cartridge Magnetic Tape Drive it is possible to increase the tape utilization to 100% while at the same time obtain the advantages of short block lengths. These advantages are provided by the format shown in Figure 2.

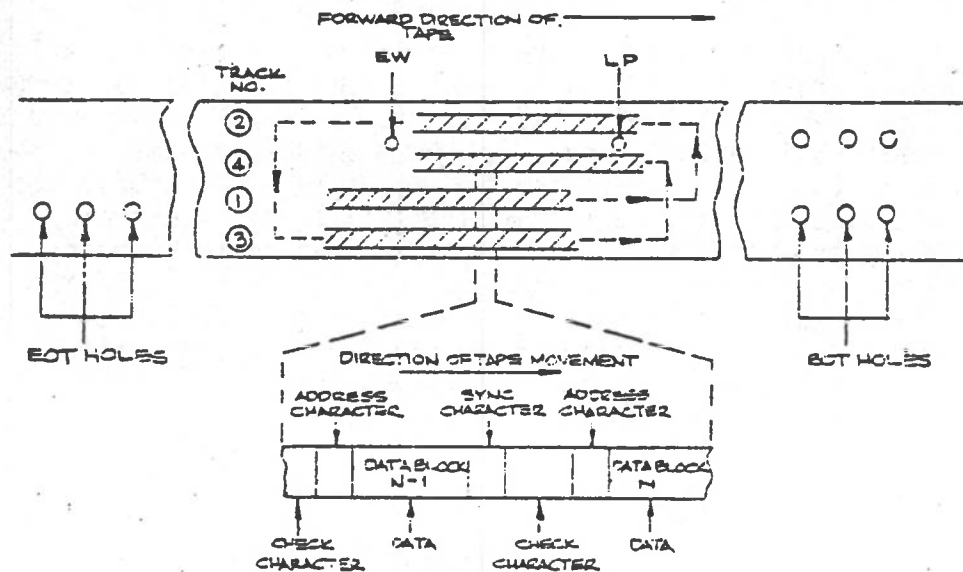


FIGURE 2. STREAMING TAPE FORMAT, 4 TRACK SERPENTINE

Architecture of Streaming Cartridge Magnetic Tape Drive:

Figure 3 illustrates the architecture used in the DEI Streaming Cartridge Magnetic Tape Drive. This architecture provides the following functions:

1. Formatting of incoming data to limit the effect of drop-outs and hence the range that the error correction needs to cover.
2. Code conversion to generate a self-clocking recording code.
3. Generation of synchronization, block address, and check characters.
4. Control of data during track changes.
5. Read-While-Write data verification (after full tape erase).
6. Rewriting of marginally recorded data blocks.
7. Recovery from soft errors.

8. Control of tape position following power-up, cartridge insertion, and end of tape.
9. Status indication of memory capacity, data in error, file protection, and system readiness.

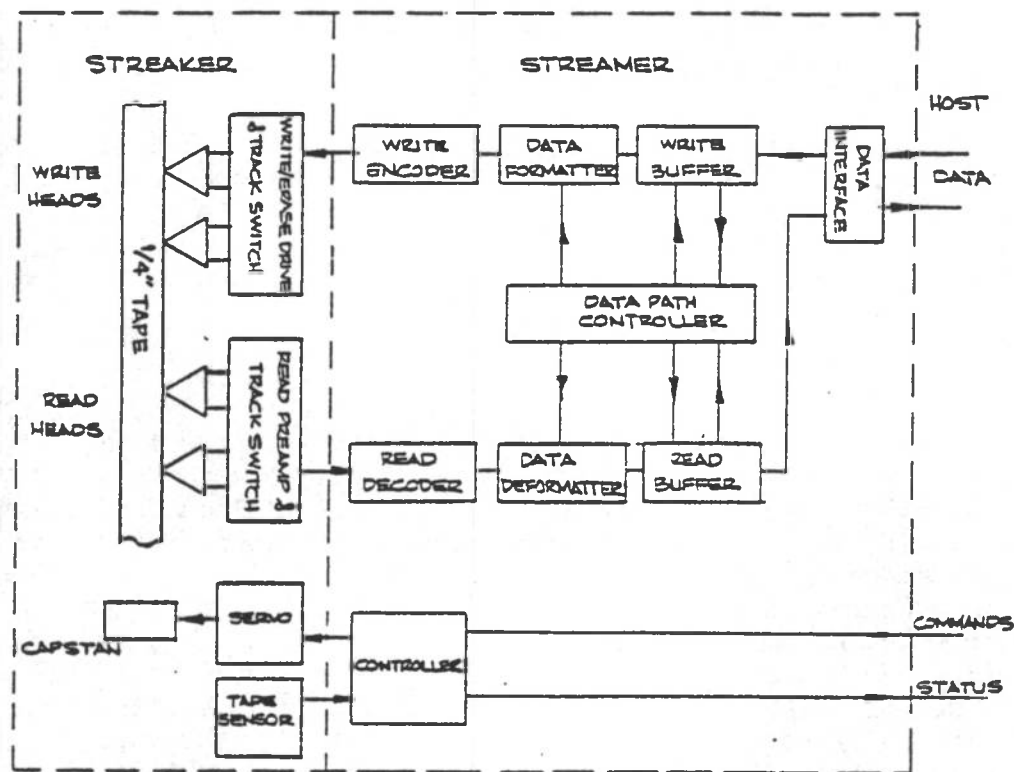
These functions will be briefly discussed in the following paragraphs.

Blocking of Incoming Data:

Data presented to the drive is in bit serial form. The drive will accumulate the incoming data in its input buffer, format the data into blockettes, append synchronizing characters, check characters, and an address to each blockette. Any data which is not written at the end of the save (dump) operation will be written when a reset command is given and will contain an end of data flag to prevent subsequent apparent tape run away.

Code Conversion:

The drive will record the data on tape in a bit serial format. The recorded data will be converted for binary to a self-clocking code. The code is selected from optimum use of the system passband and the short term speed characteristics of the cartridge. It assumes optimum use of the data space comensurate with achieving cost and capacity objectives.



-- FIGURE 3. BLOCK DIAGRAM OF STREAMING CARTRIDGE MAGNETIC TAPE DRIVE

Control of Data During Track Change:

The drive will record the data on two or four data tracks (2 tracks for 10 megabytes version and 4 tracks for 20 megabytes version), with the tracks configured in a serpentine arrangement (no rewind between tracks). Data will be internally managed during the stop, ramp down, track change, and ramp back up to speed in the opposite direction. During this sequence, the drive will hold off the incoming data from the host system.

Rewriting of Marginal Data:

Data written on tape will be evaluated on the fly by means of a read-while-write check for its integrity with respect to various analog and digital parameters. If the recorded data quality does not satisfy any one of these parameters, it will be rewritten. This process is essentially a total system record quality assurance algorithm. The basic premise is to assure that all recorded data has a substantial data recovery margin. During the read mode only the first correctly read blockette will be sent to the host system. It will be necessary to hold off the host during the rewriting process.

Recovery From Soft Errors:

The drive includes a tape cleaner which provides a means of removing foreign particles embedded into the oxide surface of the tape which are the predominant cause of errors. This will allow for removal of the error causing particles and will allow for an improved data recovery probability during read retries. The retries are provided to recover from read errors or soft errors. It will be necessary to hold the host off during this recovery period.

Control of Tape Position:

The drive will automatically rewind the tape to beginning-of-tape following power up and upon the initial insertion of the tape cartridge. The drive controls the cartridge tape position in an invisible fashion to the host system. This includes preventing the tape from running off either the supply or the take-up reel and management of the tape during turn arounds and power failures.

Data Format on Tape:

Figure 4 illustrates the compressed data format used for streaming. This format enables the drive to operate in a streaming mode without the space penalty of interblock gaps. The format is invisible to the host as are the tape control functions. However, if data cannot be transferred to the drive at a rate sufficient to maintain streaming, a time penalty of up to 1.2 seconds is imposed each time the drive stops to wait for additional data. The 1.2 seconds is the sum of time taken for the drive to stop from a tape speed of 90 ips in the forward direction, start to 90 ips in reverse, stop, and start to 90 ips forward as illustrated in Figure 5. Further, some space penalty is also suffered when streaming is interrupted. The loss in data space is due to the read-to-write head spacing and speed variations. This loss is also illustrated in Figure 5.

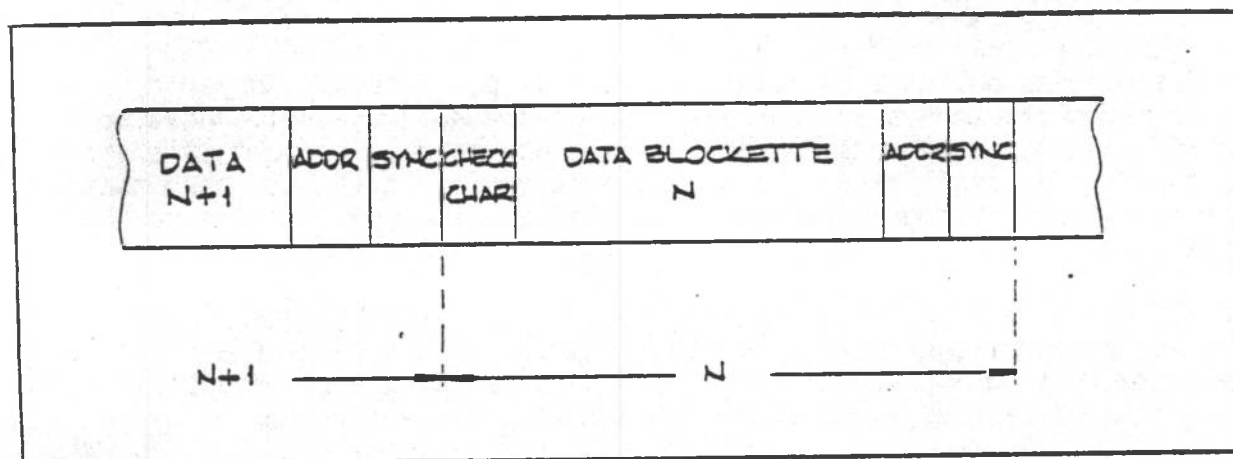


FIGURE 4 STREAMING FORMAT

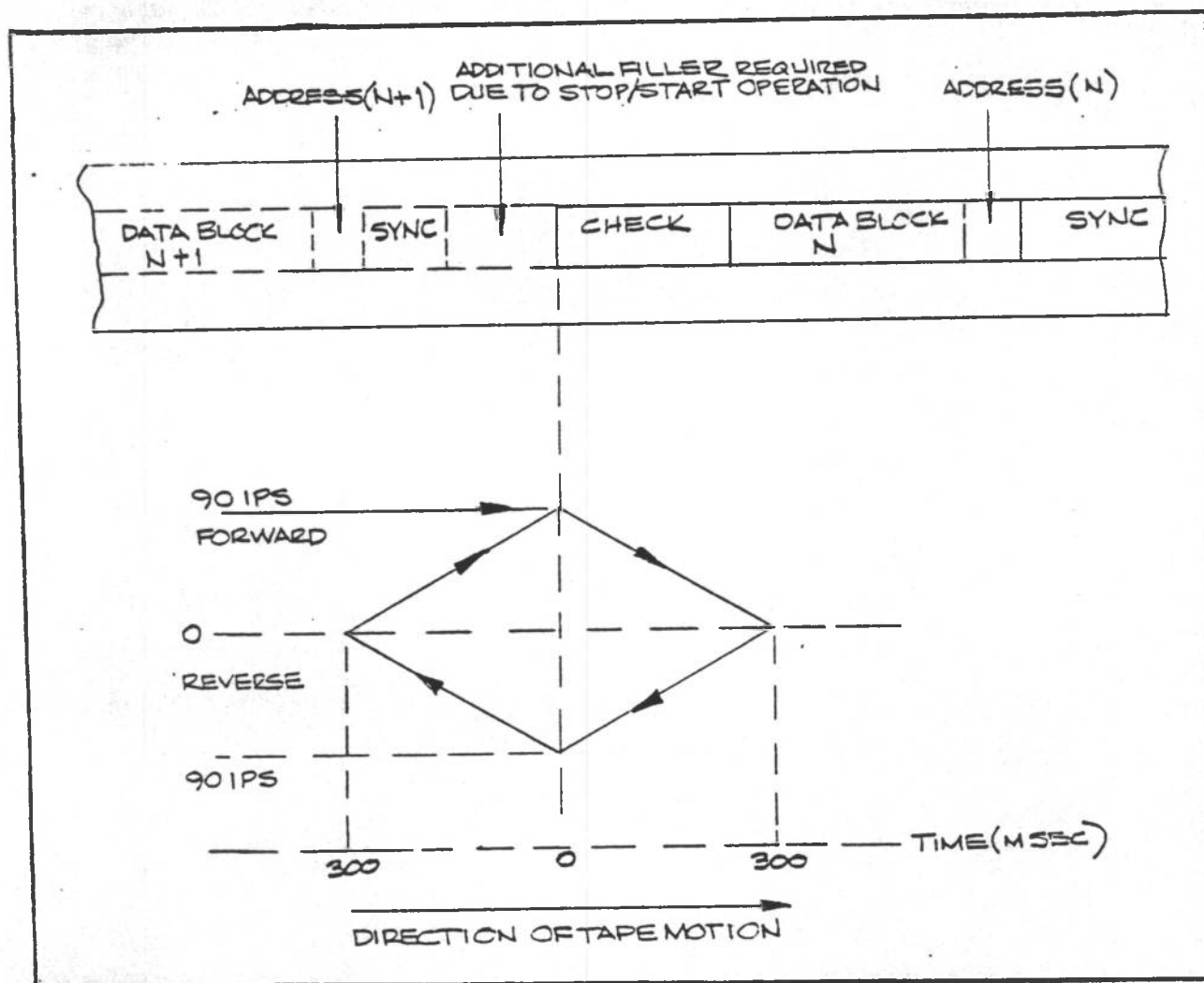


FIGURE 5. START/STOP TIMES

Maintenance of Streaming:

The drive has a nominal transfer rate of 675 kilobits per second. This transfer rate is established by balancing several parameters. The principle ones being the tape speed and passband of the data channel. However, in practice, the nominal transfer rate will be governed by circuit tolerances such as the crystal oscillator. To maintain streaming it is necessary that the host be capable of supplying data at a minimum rate equal to the maximum drive clock rate.

For the $\pm 1\%$ clock tolerance, the minimum host system transfer capability is 682 kilobits per second. To maintain streaming in the save mode (write or dump operation) it is essential that the host be capable of maintaining a minimum rate of say 690 kilobits per second to provide for some margin.

During the restore mode (read or loading) the problem is further complicated by additional speed variation due to the play back process. This adds an additional maximum rate for the transfer of 810 kilobits/sec.

The drive will support a maximum data rate of up to 950 kbits/sec. for short periods. This allows the host to unload up to 256 bytes (2048 bits) in a burst mode.

REVISIONS				
LET- TER	DESCRIPTION	DATE	CHNG	APPVD
A	Revised	11/2/76	DG	WWV
B	Revised	11/11/76	DG	WWV
C	Revised	11/17/76	DG	WWV
D	Revised	12/1/76	DG	WWV
E	Revised, page 32	9/16/78	CS	WWV
F	ECO 1301 Revised to include Codec	1-6-80	BDM	WWV
G ₁	ECO #1442	4-7-80	BDM	WWV
G ₂	Record Change, ECO #1473	5-9-80	BDM	



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DRAWN:		TITLE: Product Specification	
CHECKED:		Series CMTD-3400 S2 Drive	
APPROVED: WWV		6400 BPI	
SIZE:	DOCUMENT NO:	SCALE	
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APPLICATION:			

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PRODUCT SPECIFICATION
SERIES CMTD-3400S2

1.0 SCOPE

This specification describes the Cartridge Magnetic Tape Drive - CMTD-Series 3400 - S2 Version, (hereinafter referred to as "Drive") specifically designed for 6400 bpi recording. The Drive employs as storage media a data cartridge which is mechanical as described per ANSI Standard X3B5/75-43 - and records and reads cartridges at data densities of 6400 bpi. The Drive and cartridge are to be used as a read and write memory device in a digital system. While other formats are possible this specification specifically describes the Drive performance within the context of the data format and code listed in Section 7.

1.1 Features

The Drive will record and reproduce data onto and from cartridges which mechanically conform to the ANSI Standard in a compatible fashion, as such cartridges will be interchangeable.

The Drive consists of a set of optional features. Optional features include the existence of control and codec boards.

1.2 Applicable Documents

American National Standards Institute (ANSI) X3.55-1977, Unrecorded Magnetic Tape Cartridge for Information Interchange, .250 inch (6.30 mm) used as a mechanical guide. Cartridge read/write performance shall be as required by Data Electronics, Inc., High Density Cartridge Specification 300,671.

NOTE: These specifications may change without notice.



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1.3 Specification Summary

Details for each item listed below can be found in the body of this specification.

PARAMETER	VALUE
I. DATA: TRANSFER RATE CAPACITY, UNFORMATTED CAPACITY, FORMATTED (8K BYTE BLOCK) RECORDING FORM RECORDING CODE HEAD FORMAT NUMBER OF RECORDED TRACKS RECORDING DENSITY DATA RELIABILITY SOFT ERROR RATE HARD ERROR RATE	192 X 10 ³ BITS/SEC 17.3 X 10 ⁶ BYTES 15.2 X 10 ⁶ BYTES HEAD UP FROM BOT (ANSI) MFM READ WHILE WRITE WITH ERASE FOUR 6400 BITS/IN < 1 ERROR IN 10 ⁸ BITS < 1 ERROR IN 10 ¹⁰ BITS
II. MOTION: SPEED, READ WRITE SPEED, SEARCH REWIND SPEED VARIATION, SHORT TERM SPEED VARIATION, LONG TERM START/STOP PERIOD START/STOP DISTANCE @ READ WRITE SPEED @ SEARCH REWIND SPEED	30 IN/SEC 90 IN/SEC +3% +2% 25/26 X 10 ⁻³ SEC 0.300/0.405. INCHES 2.97/3.42 INCHES
III. POWER: * SERVO OTHER DISSIPATION: TYPICAL MAXIMUM	±24 ±15% VDC @ 1.3A TYP +5 ±4% VDC @ 1.6A TYP 18 WATTS 69 WATTS
IV. PHYSICAL: * OVERALL WIDTH X HEIGHT X DEPTH WEIGHT SIGNAL I/O MATING CONNECTOR POWER I/O MATING CONNECTOR	6.96 X 4.25 X 5.72 INCHES 4.2 LBS 3M: 3425-3000 CANNON: 121-7326-10843 AND CANNON: 121-7326-702 WITH CONTACTS 11-0238-0091, KEYS 225-7301-003
V. ENVIRONMENT: OPERATING TEMP STORAGE TEMP RELATIVE HUMIDITY	5 to 45°C -30 to +60°C 20 to 80% RH
VI. MACHINE RELIABILITY: MEAN TIME BETWEEN FAILURES MEAN TIME TO REPAIR	>3000 HOURS <1.0 HOURS

* ASSUMES DRIVE WITH
 CONTROL AND CODEC
 (MODEL NO. 3447-44ABDEF-S2)



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PRODUCT SPECIFICATION

SERIES CMTD-3400S2

1.0 SCOPE

This specification describes the Cartridge Magnetic Tape Drive - CMTD-Series 3400 - S2 Version, (hereinafter referred to as "Drive") specifically designed for 6400 bpi recording. The Drive employs as storage media a data cartridge which is mechanical as described per ANSI Standard X3B5/75-43 - and records and reads cartridges at data densities of 6400 bpi. The Drive and cartridge are to be used as a read and write memory device in a digital system. While other formats are possible this specification specifically describes the Drive performance within the context of the data format and code listed in Section 7. .

1.1 Features

The Drive will record and reproduce data onto and from cartridges which mechanically conform to the ANSI Standard in a compatible fashion, as such cartridges will be interchangeable.

The Drive consists of a set of optional features. Optional features include the existence of control and codec boards.

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NOTE: These specifications may change without notice.



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MODEL DESCRIPTION AND CORRESPONDING NUMBER

Denotes Standard Configurations

PRODUCT SERIES	RECORDING DENSITY N1	HEAD TYPE N2	TAPE SPEED N3	-	NUMBER OF TRACKS N4	CONFIGURATION N5	S2
3	4: 6400 bpi	4: Dual Gap With Erase (Read-While-Write)	7: 30/90 ips	-	4: Four Track Serial	4: Control Board Supplied 5: No Control Board Supplied	A: Integral Tape Cleaner B: File Protect & Cartridge in Place Switches C _n : Unit Addressing factory set (Specify C1→C2)* D: Unit Addressing Customer Select * E: Internal Line Termination Supplied F: With Codec Board
3	4	4	7	-	4	4	ABDEF S2

* C_n for Drives without Control Board (where n is unit address number, 1 or 2).

D for Drives with Control Board.



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FIGURE 1.2-1

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1.4 Model Specification

To describe the specific model, the following system will be used:

Form of Model Number: 3, N1, N2, N3, N4, N5, An

Where:

N is numeric and A is alphanumeric.

N1 = Data Recording Density

N2 = Recording Head Type

N3 = Tape Speed

N4 = Number of Tracks

N5 = Configuration

An = Options/Selections

For a specific description of the set of selective features available refer to Figure 1.2-1.

Example given is: 3447-4ABDEF-S2, which is a Drive configured as follows:

6400 bpi recording density

Dual Gap (read-while-write) head with erase (one erase gap per track)

30 ips read/write speed and 90 ips block search and/or rewind speed

Four Track Serial recording format

Control Board Supplied

File Protect and Cartridge in Place Sense Switches

Integral Tape Cleaner

Unit Address Select Switch

End of Line Termination Installed in Drive

Codec Board Supplied

MODEL NO	MATING CONNECTOR SET PART NO.	
344X-45ABC1E-S2	301,381	Group 1
344X-44ABDE-S2	301,382	Group 2
344X-44ABDEF-S2	301,383	Group 3



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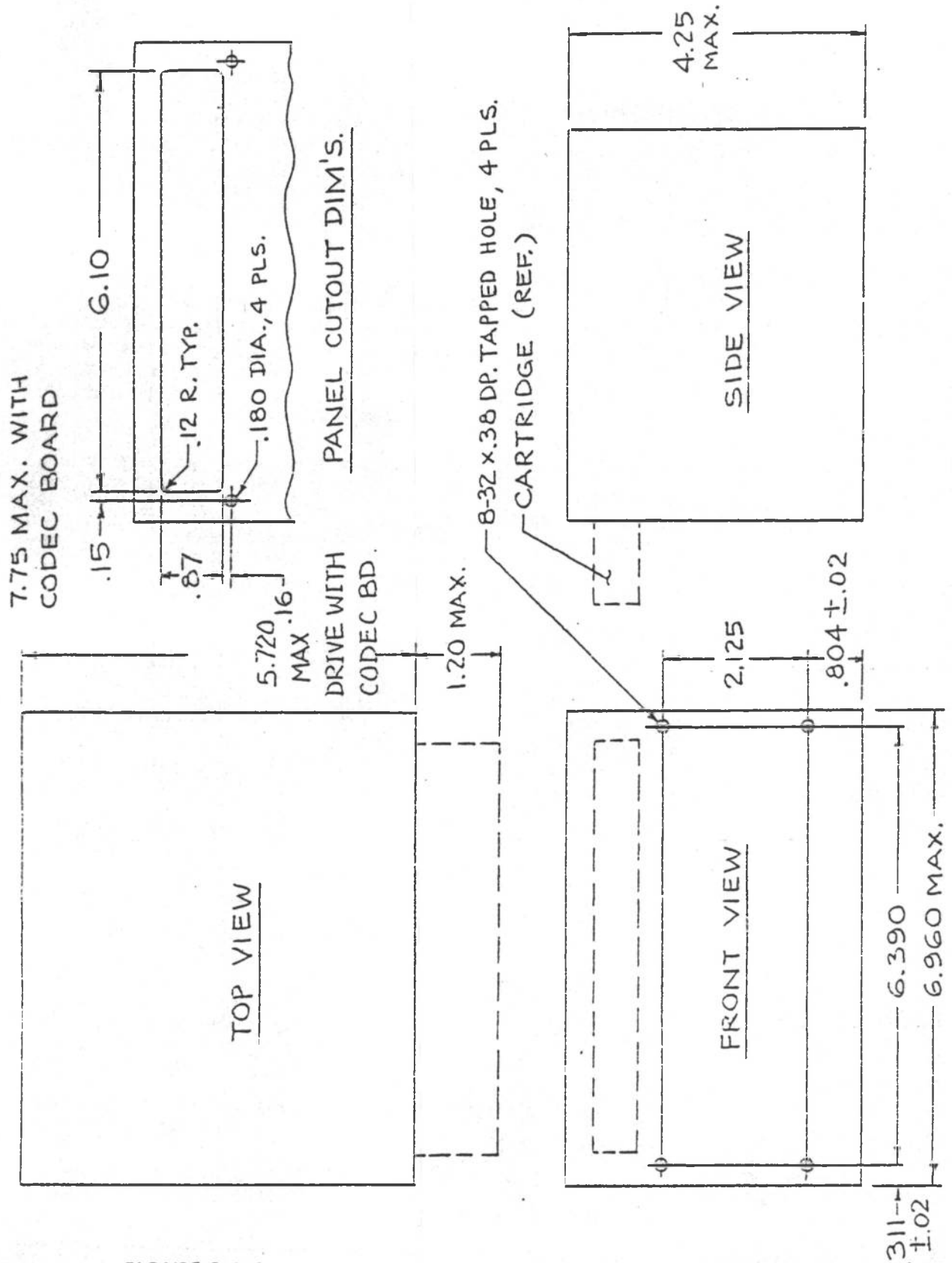


FIGURE 2.1-1
PANEL MOUNTING DIM.



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2.0 PHYSICAL SPECIFICATION

The Drive consists of a base structure which is the primary mechanical support for the internal elements and provides the mechanical support for mounting of the Drive. The primary elements of the Drive are the magnetic head, the sensor assembly, the data board, the servo board, the interconnect board, the heat sink assembly and the basic mechanical assembly to which all the above are attached. Further optional assemblies are the control and codec boards.

2.1 Mounting

The Drive can be mounted in any orientation without affecting performance except when the optional tape cleaner is used. In this case, the Drive should not be mounted so that material which is removed from the tape can fall back onto the tape surface due to gravity. Therefore, orientations wherein the oxide surface of the tape is upward are not recommended.

Various methods can be used to mount the Drive but panel mounting is usually most convenient. The Drive is therein attached, via four screws, to the rear side of a vertical or horizontal panel. A single opening is required for cartridge access (refer to Figure 2.1-1). The orientation of the unit behind the panel is optional.

2.2 Ambient Conditions

In general, no forced cooling is required. The Drive can dissipate up to 69 watts (typical value: 18 watts), therefore sufficient free air flow is required to prevent the local ambient air from exceeding 113°F (45°C) under operating conditions. If conditions require forced cooling to achieve this condition (e.g., insufficient free air flow) then air should be supplied as shown in Figure 2.2-1.

Operating Temperature	41°F to 113°F (5°C to 45°C)
Storage Temperature:	-17°F to 150°F (-30°C to 60°C)
Temperature Rate of Change:	≤1.8°/minute (1°C/minute)
Operating Humidity:	20% to 80% non-condensing
Storage Humidity:	0% to 99% humidity - non-condensing
Warm-Up Time:	Less than 1 sec. (i.e., time when operational after application of power)
Shock Non-Operational	<30 g's, all axis
Vibration Non-Operational	<0.1g 5-200 Hz
Vibration Operational	<0.1g 5-100 Hz



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2.3 Physical Parameters

Weight:	4.2 pounds (1.9 Kg) (without cartridge)
Finish:	Metal surfaces treated to prevent corrosion, where required
Read to Write Gap Spacing:	$\leq .306$ in. (.777 cm)
Erase to Write Gap Spacing:	$.300 \pm .005$ in. (.762 cm)
	$.265 \pm .010$ in. (.673 cm)
Write Gap to Center Line of EOT/BOT Sensor:	$2.500 \pm .06$ in. (6.35 cm)

2.4 Cartridge Loading and Unloading

The Drive loads and unloads a cartridge, previously specified, as follows:

To install a cartridge, it is first positioned at the entry opening (refer to Figure 2.1-1) and slid inward until a firm stopping point is felt. The pressure is then released and the Drive positions the cartridge into its operating location. The positioning mechanism provides spring loading to engage the cartridge upper base surface against a fixed stop and to engage the cartridge against two point front surface reference in the other axis.

To remove the cartridge, pull cartridge out of the Drive.

The loading and unloading mechanism positions the cartridge relative to the recording head so that compatible recording or reproducing can occur, and shall not damage the cartridge in such a way as compatible recording and reproducing cannot occur.



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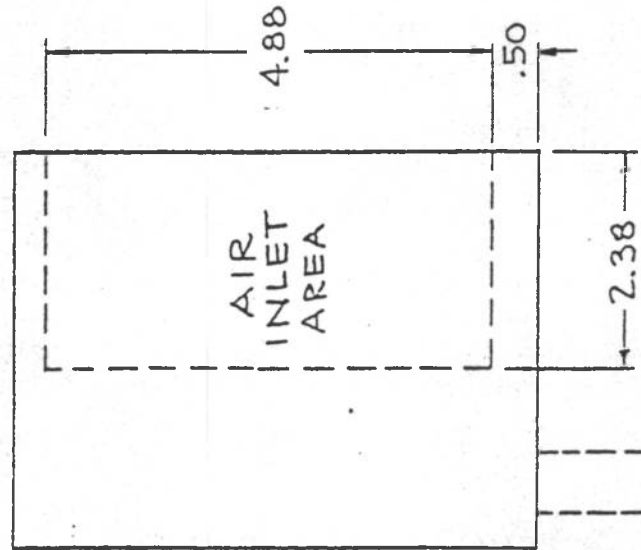
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SIDE VIEW



AIR
INLET

TOP VIEW

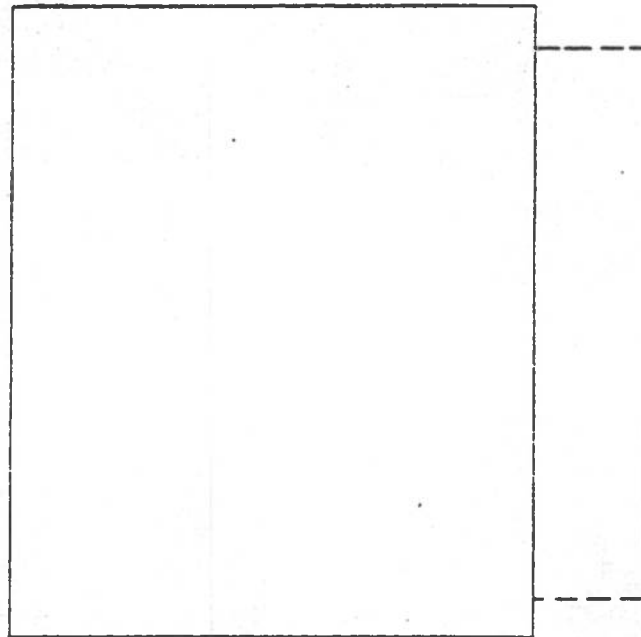


FIGURE 2.2-1
AIR COOLING DIAGRAM



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3.2 Interface Requirements for Basic Model Drives

3.2.1 Control and Status Interface

The interface between the Drive and the controller is single ended, TTL compatible, except for the data signals.

All input and output lines except data are defined as true low (0 to .8 VDC), and all Drive output lines are driven by an open collector or tri-state driver (25 ma maximum sink current). Input lines into the Drive supply various 74XX gates.

Proper line termination is required and subject to the exact cable used. For a 132 Ω cable the line termination shown in Figure 3.2.1-1 is recommended (can be used for 100-132 Ω cables).

End of line termination can be supplied in the Drive, and is shown in Figure 3.2.1-1 for all received command signals.

3.2.2 Data Signal Interface

The data signals, (Read Data and Write Data), are differential type. The Read Data signals (RDA+, RDA- and DAO+, DAO-) are driven by a SN 75110, or similar differential driver and the Write Data signals (WDA+, WDA-) are received by a differential receiver type LM 360 or similar. The data signal are designed for balanced transmission line operation and line termination within the Drive is optional.

The signal specification voltage swing shall be at least +50 mv but shall not exceed +3V, assuming a properly terminated line (refer to Figure 3.2.2-1) is being driven/received. The current to be sourced by the driver is 6.5 to 15 ma/leg. The recommended termination shown in Figure 3.2.2-1 will vary with the characteristic impedance of the cable as used. The maximum signal rise or fall time is 50 nsec.



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3.0 ELECTRICAL SPECIFICATIONS

3.1 Power Supply Requirements

The voltages and corresponding current requirements for the Drive are listed in Table 3.1-1.

POWER DRIVE TYPE	DRIVE POWER DISSIPATION, WATTS		OPERATING* CONDITIONS	CURRENT REQUIREMENTS IN AMPERES (TOLERANCES INCLUDE RIPPLE)					
				+24VDC $\pm$ 15%		-24VDC $\pm$ 15%		+5VDC $\pm$ 5%-3%	
				AMPS		AMPS		AMPS	
				TYP.	MAX.	TYP.	MAX.	TYP.	MAX.
BASIC MODEL	15	63	1	0.1	0.1	0.2	0.3	0.4	0.9
			2	0.1	0.1	1.0	1.9	0.4	0.9
			3	0.9	1.7	0.2	0.3	0.4	0.9
			4	1.6	3.1	1.7	3.5	0.4	0.9
BASIC MODEL WITH A CONTROL BOARD	17	67	1	0.1	0.1	0.2	0.3	0.9	1.8
			2	0.1	0.1	1.0	1.9	1.0	2.0
			3	0.9	1.7	0.2	0.3	1.0	2.0
			4	1.6	3.1	1.7	3.5	1.0	2.0
BASIC MODEL WITH A CONTROL AND CODEC BOARD	18	69	1	0.1	0.1	0.2	0.4	1.2	2.4
			2	0.1	0.1	1.0	2.0	1.3	2.6
			3	0.9	1.7	0.2	0.4	1.3	2.6
			4	1.6	3.1	1.8	3.5	1.3	2.6

TABLE 3.1-1

* Operating Conditions:

1. No tape motion, no write current.
2. Forward tape motion at 30 or 90 ips (includes writing conditions at 30 ips).
3. Reverse tape motion at 30 or 90 ips (no write current).
4. Start/Stop Periods: 30 ips 25/26 mSec., 90 ips 71/74 mSec.

General:

- All voltages measured at drive power connector.
- The ramp period current peaks do not occur simultaneously. A defective cartridge can extend ramp current periods.

Assumption for power dissipation calculations:

Typical: Nominal voltages and typical currents, .2 starts and 2 stops per second, and running 50% of the remaining time.

Maximum: Nominal voltages and maximum currents and 17 starts and 17 stops per second.



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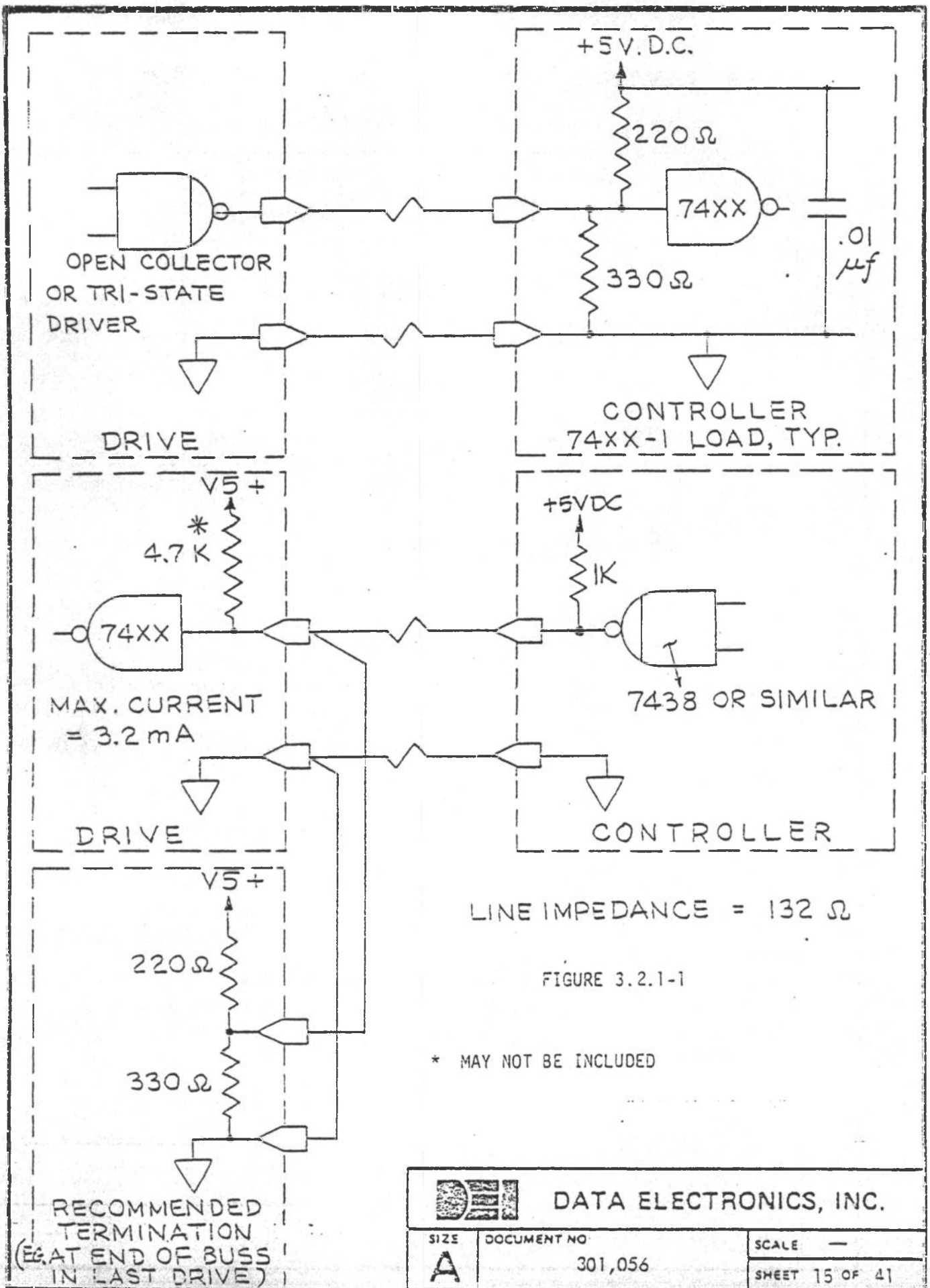
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3.3 Interface Requirements for Drives With Control Boards

3.3.1 Control and Status Interface

The interface between the Drive and the controller is single ended, TTL compatible, except for the data signals.

All input and output lines except data are defined as true low (0 to .8 VDC), and all Drive output lines are driven by an open collector or tri-state driver (25 ma maximum sink current). Input lines into the Drive supply various 74XX gates. Up to 8 Drives can share a common buss cable.

Proper line termination is required and subject to the exact cable used. For a 132 Ω cable the line termination shown in Figure 3.2.1-1 is recommended (can be used for 100-132 Ω cables).

End of line termination can be supplied in the Drive, and is shown in Figure 3.2.1-1 for all received command signals. All input signals except data have a pull-up resistor as shown in Figure 3.2.1-1.

3.3.2 Data Signal Interface

The data signals, (Read Data and Write Data), are differential type. The Read Data signals (RDA+, RDA- and DAD+, DAD-) are driven by a SN 75110, or similar differential driver and the Write Data signals (WDA+, WDA-) are received by a differential receiver type LM 360 or similar. The data signal are designed for balanced transmission line operation and line termination within the Drive is optional.

The signal specification voltage swing shall be at least ± 50 mv but shall not exceed ± 3 V, assuming a properly terminated line (refer to Figure 3.2.2-1) is being driven/received. The current to be sourced by the driver is 6.5 to 15 ma/leg. The recommended termination shown in Figure 3.2.2-1 will vary with the characteristic impedance of the cable as used. The maximum signal rise or fall time is 50 nsec.

3.4 Interface Requirements for Drives with Control and Codec Boards

3.4.1 Control, Status and Data Interface

The interface between the Drive and the controller is signal ended, TTL.



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All input and output lines are defined as true low (0 to .8 VDC), and all Drive output lines are driven by an open collector or tri-state driver (25 ma maximum sink current). Input lines into the Drive supply various 74XX gates.

Proper line termination is required and subject to the exact cable used. For a 132 Ω cable the line termination shown in Figure 3.4.1-1 is recommended (can be used for 100-132 Ω).

End of line termination can be supplied in the Drive, and is shown in Figure 3.4.1-1 for all received command signals. All input signals have a pull-up resistor as shown in Figure 3.4.1-1.

3.5 Connectors

3.5.1 Power

Power is attached as shown in Figures 3.5.1-1, -2 and -3 depending on type of Drive. The power connectors are as shown. 20 AWG is recommended for power cable wire size.

3.5.2 Input/Output

When no control board is supplied the input and output cable is a 40 conductor flat cable. The I/O connector is attached to the Drive shown in Figure 3.5.1-1.

When a control board is specified, the recommended mating plug is as shown and the I/O connector is attached to the Drive as shown in Figure 3.5.1-2.

When a control and codec board are supplied the recommended mating connectors and the attachments are as shown in Figure 3.5.1-3.

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DRIVE

CONTROLLER

$$Z_C = 100\Omega$$

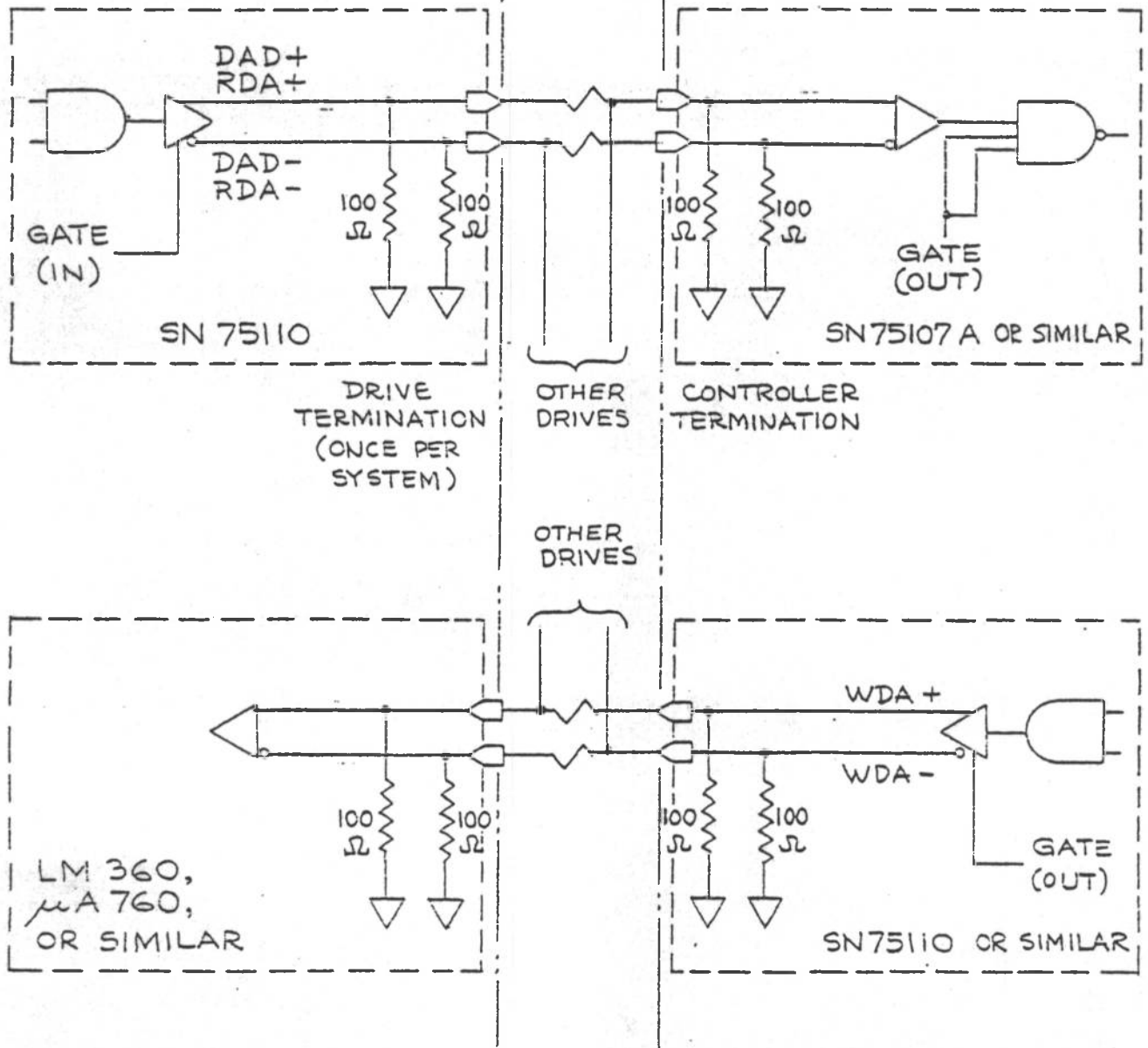


FIGURE 3.2.2-1



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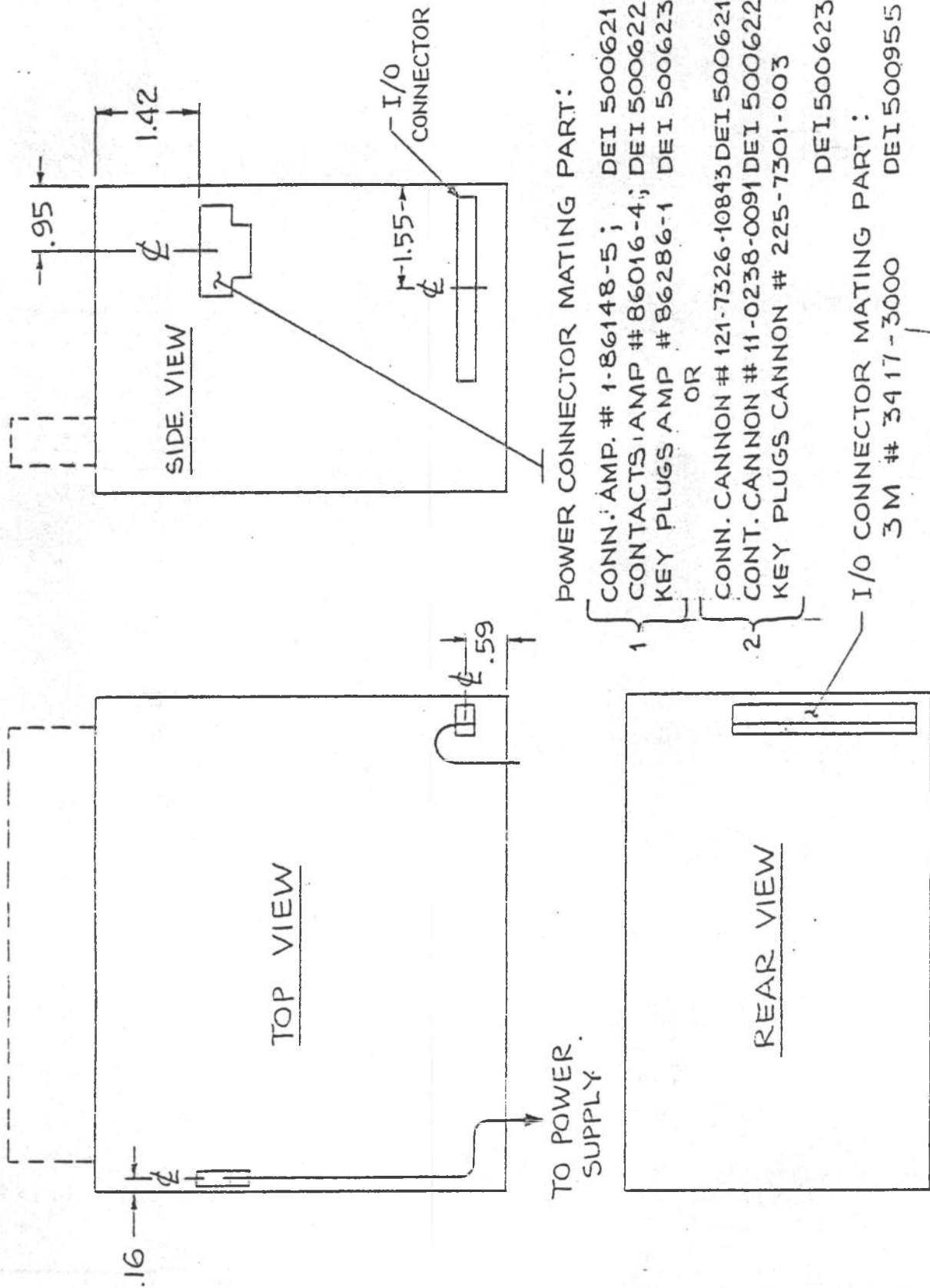


FIGURE 3.5.1-1
BASIC MODEL DRIVES

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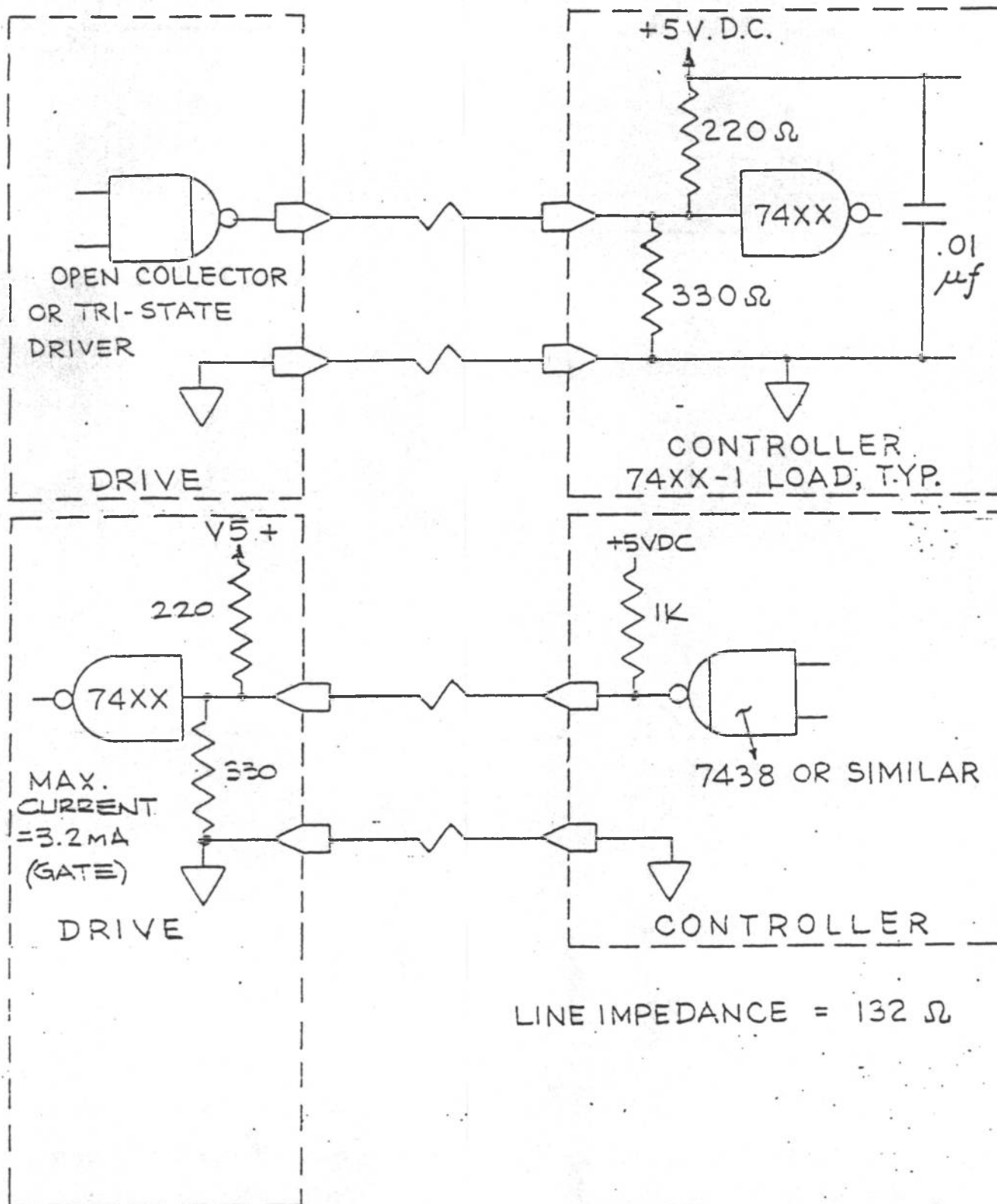
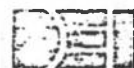


FIGURE 3.4.1-1



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DRIVE PWR MATING CONN. PART NOS.	{	OR.	AMP PART NUMBER 2-86256-2, CONNECTOR (1 EACH)
			AMP PART NUMBER 86016-4, CONTACTS (10 EACH)
			AMP PART NUMBER 86286-1, KEY PLUGS (3 EACH)
CODEC PWR MATING CONN PART NOS.	{		CANNON PART NUMBER 121-7326-10843, CONNECTOR (1 EACH)
			CANNON PART NUMBER 11-0238-0091, CONTACTS (13 EACH)
			CANNON PART NUMBER 225-7301-003, KEY PLUGS (3 EACH)
I/O MATING CONN PART NO.	{		CANNON PART NUMBER 121-7326-702, CONNECTOR (1 EACH)
			CANNON PART NUMBER 11-0238-0091, CONTACTS (5 EACH)
			CANNON PART NUMBER 225-7301-003, KEY (1 EACH)

214 PART NUMBER 3425-3000 OR EQUIV.

SIDE VIEW

REAR VIEW

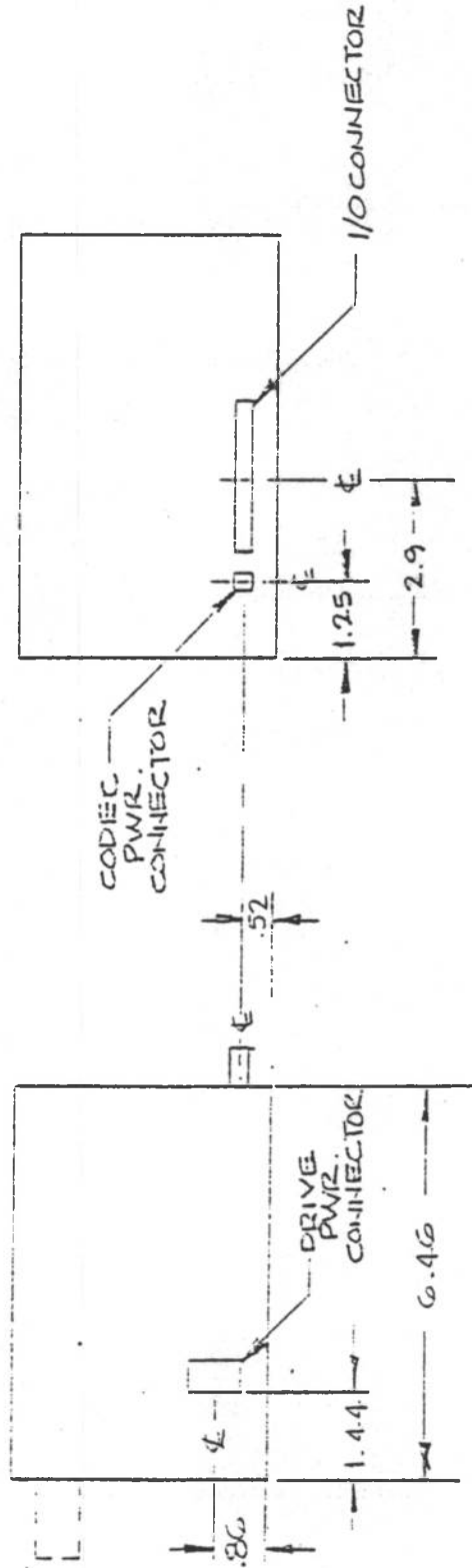


FIGURE 3.5.1-3
DRIVE WITH CONTROL AND CODEC
BOARDS

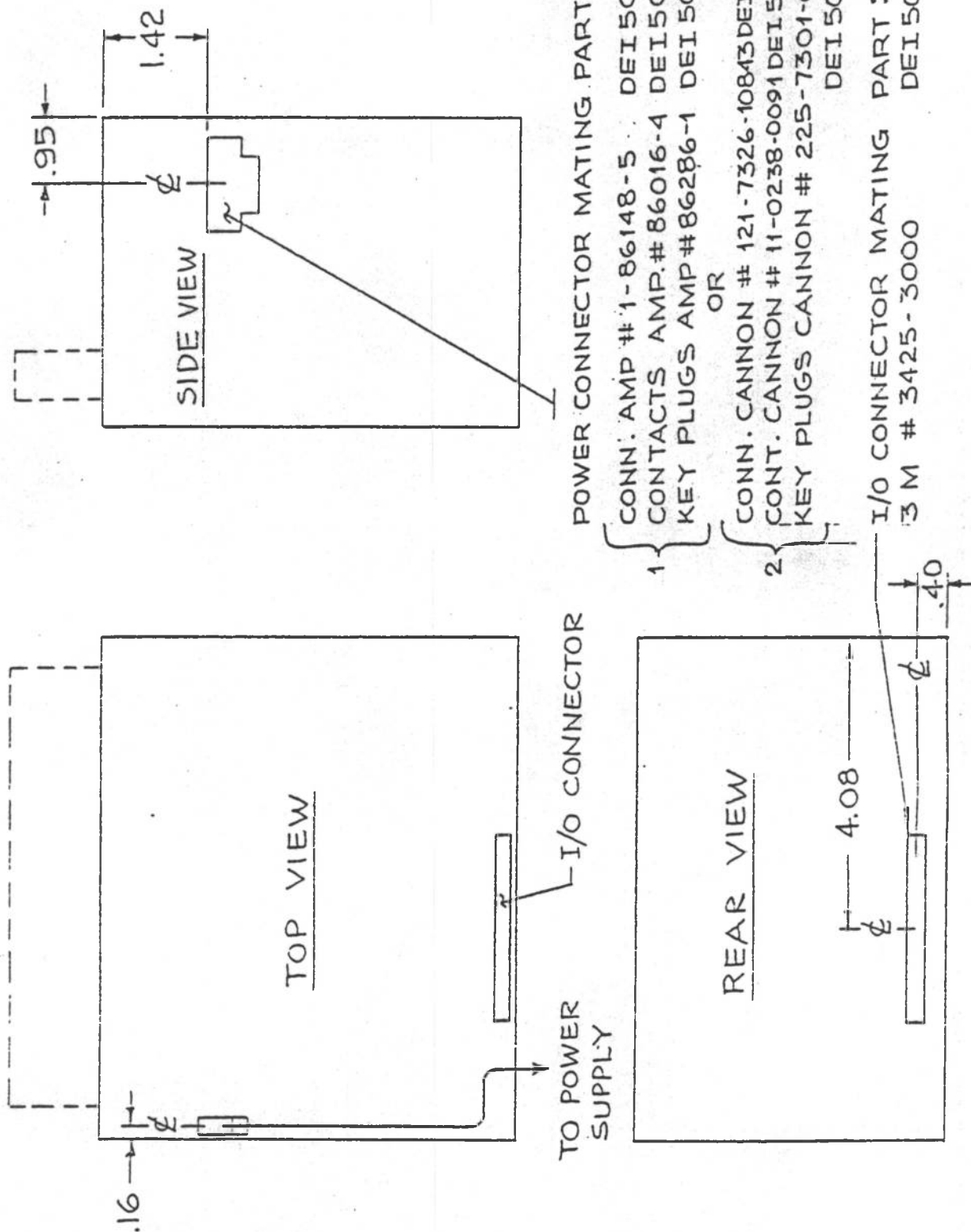


FIGURE 3.5:1-2
DRIVE WITH CONTROL BOARD



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4.0 PERFORMANCE SPECIFICATION

When the Drive is operated within the previously described conditions, the following performance shall be achieved:

4.1 Tape Motion - Steady State

4.1.1 Bit Period Definitions

The nominal bit periods for the various drive speeds and the corresponding nominal data transfer rates are shown in Table 4.1.1-1.

SPEED RANGE	NOMINAL APPARENT SPEED (IN. PER SEC)	NOMINAL BIT PERIOD (MICROSECONDS)	NOMINAL DATA TRANSFER RATE (BITS PER SECOND)
LOW	30	5.21	192,000
HIGH	90	N.A.	N.A.

TABLE 4.1.1-1

4.1.2 Long Term Tolerances

The long term average of the nominal bit period at an apparent 6400 flux reversal per inch (frpi) as shown in Table 4.1.1-1 will be within $\pm 2\%$ for 30 ips. The long term average of the nominal bit period will be within $\pm 4\%$ for high speeds.

The long term average bit period measured in a reverse direction and forward direction shall be within $\pm 3\%$.

The bit period shall be as seen at the read data signal exiting the Drive and is defined as being measured over 150 inches (3.81 m) of tape or more. The total variations are listed in Table 4.1.2-1.



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3.6 Power Transients, and Power Start-Up and Shut-Off Conditions

No power transients which exceed the limits specified in the power levels should exist on the power lines delivered to the drive under any condition.

The following shall be true during periods of power application and removal:

To avoid spurious input commands being seen by the drive, the controller should have a fail-safe method of maintaining the drive in the unselected state (SLG = False or SL1 & SL2 = False) during periods of power application and removal. If it does then the following shall be true:

During Power Removal

Presently or previously in the read mode or any other non-write mode: No writing or erasing which shall render previously recorded data unrecoverable shall occur during the power removal period.

Presently in the write mode: The recording and erase operation shall be unpredictably shut down, hence the block must be re-recorded.

Previously in the write mode (i.e., stopped in a gap after a write operation): No writing or erasing shall occur which shall render previously recorded data unrecoverable.

During Power Application

No writing or erasing shall occur which shall render previously recorded data recoverable.



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NOMINAL SPEED IN./SEC. (CM/SEC.)	CONDITION	PERIOD $\times 10^{-3}$ SEC.	DISTANCE		
			MIN. IN. (CM)	NOM. IN. (CM)	MAX. IN. (CM)
30 (76.2)	STARTING	25	.280 (.711)	.300 (.762)	.316 (.803)
	STOPPING	26	.378 (.960)	.405 (1.209)	.525 (1.334)
90 (228.6)	STARTING	71	2.701 (6.860)	2.970 (7.544)	3.201 (8.130)
	STOPPING	74	2.792 (7.092)	3.420 (8.687)	4.088 (10.13)

TABLE 4.2-1

4.3 Bit Period Tolerances

The Drive shall consume no more than $\pm 33\%$ of the available $\pm 1.3 \times 10^{-6}$ sec. data recovery window, exclusive of speed tolerances already listed.

4.4 Reliability and Failures

The herein listed failure definitions should be used in conjunction with the Data Electronics, Inc. Warranty and recommended preventive maintenance schedule; neither is contained within this document.

4.4.1 Mechanical Failure

A mechanical failure is defined as a persistent failure of the Drive mechanism to perform as specified herein and includes the ability to load, unload and properly position the cartridge for the purposes of recording and reproducing data and to act as basic mechanical structure for other Drive components.



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CONDITION	LONG TERM AVERAGE TOLERANCE			SHORT TERM AVERAGE TOLERANCE		
	DRIVE	CARTRIDGE	TOTAL	DRIVE	CARTRIDGE	TOTAL
LOW SPEED	$\pm 2\%$	$\pm 1\%$	$\pm 3\%$	$\pm 3\%$	$\pm 4\%$	$\pm 7\%$
HIGH SPEED	$\pm 4\%$	$\pm 1\%$	$\pm 5\%$	$\pm 3\%$	$\pm 4\%$	$\pm 7\%$

TABLE 4.1.2-1

4.1.3 Short Term Tolerances

The short term average bit period at 6400 frpi is shown in Table 4.1.1-1 will be within $\pm 3\%$ of the long term average bit period during recording. In a subsequent read mode an additional $\pm 7\%$ short term speed can occur. The short term speed observations shall be from 5Hz to 20 KHz.

4.2 Tape Motion, Starting and Stopping

The start distance is defined as the period from application of the state (either forward or reverse) command to when $>95\%$ of final long term speed is reached, exclusive of short term speed changes. For values of start distances, refer to Table 4.2-1.

The minimum stopping distance shall always be greater than the maximum starting distance for 30 ips. An interrecord gap of 1.2 inches (3.048 cm) shall be achievable for 30 ips. A delay of 33×10^{-3} sec is required during writing to assure a minimum 1.2 inch interrecord gap. The delay is starting at the beginning of the Forward command.

The stop distance is the actual tape distance traveled during the stop period. During the stop period, which begins when the Drive motion is set false, the tape shall stop.

Within the values listed in Table 4.3.2-1, no limitations exist for the application of the start/stop commands.



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will remain set after deselection. This signal should not be reset until the drive has stopped. This signal should be set prior to drive motion. At least 2 milliseconds should be allowed between the reset of Write Enable and the changing of the track select signals.

WDA-, WDA+:

This signal will modulate the write head to produce a recorded waveform on tape when WEN- is true and the cartridge is in the unprotected state (not safe). This signal shall continue to modulate the write head if WEN is set and the cartridge is not protected independent of the drive selection.

To change to a WDA+ = H, WDA- = L state shall cause a comparable change to be made on the RDA signal lines when read back.

The minimum clock period for data input should not allow the nominal resultant number of flux reversal from exceeding 6400 per inch (2520 flux reversal/cm).

FWD-:*

Causes forward tape motion; the speed is set by the High Speed signal.

REV-:*

Causes reverse tape motion; the speed is set by the High Speed signal.

HSP-:

Causes the tape to move at High Speed in the direction set by FWD or REV.

TR2-, TR1- :

Track select address: a binary number, (true low), in the following form:

$$2^1 \ 2^0$$

Where 2^1 is TR2- and 2^0 is TR1-.



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4.4.2 Control Failure

A control failure is defined as a persistent failure of the Drive to respond to external commands or supply a status signal as specified herein. This assumed that all of the specified requirements have been met during the unit's life.

4.4.3 Data Failure

A data failure is defined as a persistent failure in the Drive to write or read data as specified herein with an error rate in excess of that specified herein. The error rate assumes a cartridge per specifications listed herein that has been certified to be free of recordable areas which fall below 30% of the nominal amplitude at 6400 frpi. Cartridge permanent errors are to be excluded. A temporary (soft) error is defined as any particular error which persists for ten (10) or less successive read and/or write attempts. A permanent (hard) error is one which persists for after ten (10) retries in the read or write mode.

4.4.4 Data Reliability

The temporary error rate shall be less than 1 error in 10^8 bits read wherein recording and reading is done on a Drive as specified herein.

The Drive, in a laboratory environment, shall have a permanent error rate of less than 1 error in 10^{10} bits read assuming the recording and reading is done on a Drive as specified herein.

5.0 INTERFACE DESCRIPTION

5.1 I/O Signals for Basic Model Drives

5.1.1 Input Signals

SL2-, SL1-:

Up to two Drives can share a common buss; drive is selected by either signal depending on internal address which must be specified. The Drive will not return status nor accept commands unless selected, except as specified below.

WEN-:

When true, shall enable the writing and erasing functions for the selected track. The writing and erasing processes shall occur only if the cartridge is in the unprotected state (not safe). This signal



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The track selection is decoded as follows:

ANSI Track Number	TR2- 2 ¹	TR1- 2 ⁰
1	H	L
2	L	H
3	L	L
4	H	H

*: Simultaneous FWD & REV = True shall not cause damage to the drive but tape motion resulting is unpredictable.

The track selection will select all heads for a given track (i.e., erase, write, and read). The last track selection shall be stored within the drive even after deselection by the controller.

5.1.2 Output Signals

FIP-: The cartridge installed sensed by CIP is protected, i.e., cannot be written on under any operational conditions.

BLB-: Power is applied to Drive (+5VDC present) and sensor bulb is drawing current (is on).

LTH-, UTH-: Either upper (UTH) or lower (LTH) hole has been sensed. These signals are true for period of sensor activity (≥ 100 μ sec.) only.

CIP-: Cartridge is installed in Drive.

RDA+, RDA-: This signal is a replica of the WDA data written onto the tape except as specified herein.

The read signal is always available. The read signal lines should only be examined for valid data when DAD is true (low).

DAD+, DAD-: This signal, Data Detected, will indicate that the Read Data signals are valid for the particular mode of operation. The Read Data signals should be only be examined when DAD is true. DAD will go true ≤ 16 μ sec. after the first valid data transition is read from tape. This will remain true if at least two data transitions which exceed the threshold criteria are read from tape in the 16 μ sec. period.



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The DAD signal will remain true for up to 62 μ sec. after the last data transition is read from a block, (the data transitions which have met the threshold criteria).

The DAD true state shall be DAD+ = High, DAD- = Low.

5.2 I/O Signals for Drives with a Control Card

5.2.1 Input Signals

The input signals from the controller to the Drive are as follows:

5.2.1.1 Unit Addressing

Up to eight (8) Drives can exist on a single buss. Each Drive is individually addressable by the following:

SLG- Select Gate: When true, enables selection per the select or address code. It is used to prevent unwanted transient selection during changes in the select address.

SL4- } Unit Select address in the form of a binary number
SL2- } (true low):
SL1- }

$$2^2 \ 2^1 \ 2^0$$

wherein 2^2 is SL4-, 2^1 is SL2- and 2^0 is SL1-. The address is decoded by the Drive as follows:

Logical Address	SL4-	SL2-	SL1-
1	H	H	L
2	H	L	H
3	H	L	L
4	L	H	H
5	L	H	L
6	L	L	H
7	L	L	L
8	H	H	H

The Drive is equipped with a unit address switch to provide customer selection of unit addresses. The switch nomenclature shall numerically correspond to the logical address as shown in the table above.



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The addressing function shall proceed and remain during any other Drive input and output function except where noted.

5.2.1.2 Motion

Tape motion shall be commanded by the following lines:

FWD-: When true, causes the tape to move in a forward direction.

REV-: When true, causes the tape to move in a reverse direction.

HSP-: When true, causes the tape to move at high speed in the direction selected by either FWD- or REV-.

Tape motion shall proceed until the command signals go false or:

In forward where a EOT hole is encountered whereupon motion shall stop.

In reverse where a set of BOT holes is encountered whereupon motion shall stop.

Both directions are commanded simultaneously whereupon the tape shall stop.

Rewind command is received which shall overrule other motion commands.

Internal Ready signal is not true whereupon motion will stop.

In High Speed motion, will drop to low speed when the upper "load point" hole is sensed in reverse or the upper "early warning" hole is sensed in forward.

RWD-: When true, causes the tape to be positioned to beginning of tape at high speed. The Drive must be selected to start a Rewind sequence, but may be unselected after the sequence is started.



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Beginning of tape is defined as between the two innermost (toward the middle of the tape) set of upper and lower holes located at the "head end" of the tape. This location is recommended for unloading the cartridge as the data recording area is completely protected.

Rewind shall "override" all other motion signals. Successive Rewind commands shall not cause the tape to be "run off".

Rewind shall stop if the Internal Ready signal is false.

An automatic Rewind sequence is executed when a cartridge is installed in the Drive or when power is applied when a cartridge is installed.

5.2.1.3 Data Signals

The data input process requires the following:

$\left. \begin{array}{l} \text{TR2-:} \\ \text{TR1-:} \end{array} \right\}$ Track select address: a binary number, (true low),
 in the following form:

$2^1 \ 2^0$

Where 2^1 is TR2- and 2^0 is TR1.

The track selection is decoded as follows:

ANSI Track Number	TR2-	TR1-
1	H	L
2	L	H
3	L	L
4	H	H

The track selection will select all heads for a given track (i.e., erase, write, and read).

The last track selection shall be stored within the drive even after deselection by the controller.



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In the case of receipt of a non-executed or illegal command, (FWD at EOT or REV at BOT), this signal will not be true, indicating the command is rejected.

- FLG-: Will be set and latched when an automatic sequence to position the cartridge to BOT has been executed, or a rewind has been completed. This signal is reset by subsequent receipt of a FWD command.
- WND-: Will be true when a write enable condition is latched within the Drive.
- FUP-: Will be true when a cartridge is installed and it is in the unprotected state (i.e., can be written on).
- LPS-: Will be set and latched when the upper load point hole (the warning of beginning of tape) is passed in the reverse direction. This signal will be internally reset when the load point hole is subsequently passed in the forward direction. When this signal is true, high speed will be disabled. Reverse tape motion is allowed to proceed until the BOT holes are encountered where the Drive will stop and accept only forward commands.
- EWS-: Will be set and latched when the upper early warning hole (the warning at end of tape) is passed in the forward direction. This signal will be internally reset when the early warning hole is subsequently passed in the reverse direction. When this signal is true, high speed is disabled. Forward tape motion is allowed to proceed until the EOT hole is encountered where the Drive will stop and accept only reverse commands.

5.2.2.2 Data Signals

RDA+,

RDA-: This signal is a replica of the WDA data written onto the tape except as specified herein.



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WEN-: When true, shall enable the writing and erasing functions for the selected track. The writing and erasing processes shall occur only if the cartridge is in the unprotected state (not safe). This signal will remain set after deselection. This signal should not be reset until the drive has stopped. This signal should be set prior to drive motion. At least 2 milliseconds should be allowed between the reset of Write Enable and the changing of the track select signals. This signal is reset by either Reverse or High Speed commands.

WDA-: This signal will modulate the write head to produce a recorded waveform on tape when WEN- is true and the cartridge is in the unprotected state (not safe). This signal shall continue to modulate the write head if WEN is set and the cartridge is not protected independent of the drive selection.

To change to a WDA+ = H, WDA- = L state shall cause a comparable change to be made on the RDA signal lines when read back.

The minimum clock period for data input should not allow the nominal resultant number of flux reversal from exceeding 6400 per inch (2520 flux reversal/cm).

5.2.2 Output Signals

5.2.2.1 Status Signals

- SLD-: Will be true when the Drive has received its proper unit address.
- RDY-: Will be true when a cartridge is installed, the sensor lamp is drawing current, and the +5VDC is applied to the Drive.
- BSY-: Will be true when the Drive is in an automatic rewind sequence (i.e., when a cartridge is first installed in the Drive), or when the Drive is executing a rewind, forward, or reverse command. This signal will go true when the command is received and will remain true until the motion has stopped (i.e., 30 milliseconds after low speed motion has been commanded to stop and 80 milliseconds after 90 ips operation has been commanded to stop).



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DAD+, DAD-:

This signal, Data Detected, will indicate that the Read Data signals are valid for the particular mode of operation. The Read Data signals should only be examined when DAD is true. DAD will go true ≤ 16 μ sec. after the first valid data transition is read from tape. This will remain true if at least two data transitions which exceed the threshold criteria are read from tape in the 16 μ sec. period.

The DAD signal will remain true for up to 62 μ sec. after the last data transition is read from a block.

5.3 I/O Signals for Serial Drives With a Codec Board

All drives equipped with a Codec board are also supplied with control boards, therefore, for specific descriptions of these signals, refer to Section 5.2. The only deletions are the WDA $\pm$, DAD $\pm$, and RDA $\pm$ signals which are replaced by the signals which follow.

5.3.1 Input Data Signals for Drives With Codec Board

WDE- Write Data Enable: A control line to the Drive which enables the encoding function (sending of write data strobes and the writing of data on tape). The WEN function will enable both writing and erasing. WEN causes the write circuits to become active and tape to the erased. After the tape is up to speed and other conditions met, the WDE will cause the Drive to send data strobes and shall commence to record flux transitions on the tape.

The first strobe is sent $\leq 5.2 \times 10^{-6}$ sec. after WDE is true.

All data which is to be written on the tape must be sent to the Drive (all preambles, check characters, and postambles).

WNZ- Write Data. During the write data strobe period the state of the input write data line is sensed as follows:

WNZ = Low = 1, and
WNZ = High = 0

The state of WNZ is only examined during the write data strobe period. The WNZ signal must be steady 0.5×10^{-6} sec. prior to the write data strobe true period (WDS = Low) and remains during the strobe



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true period $\pm 1 \times 10^{-6}$ sec. WNZ is permitted to change on the rising (false going) edge of WDS-.

5.3.2 Output Data Signals for Drives With Codec Board

- DAD- Data Detected. Will be false except when data has been detected. Data detected requires the receipt of a number of data transitions from the tape without an intervening period of more than 20×10^{-6} sec. between transitions being received. Data detected can be used to sense the presence of blocks of data at both low and high speed.
- RNZ- Read Data. During the period of read data strobe, when RNZ is low (true), the data is a 'one'; when high, the data is a 'zero'. The RNZ signal will remain steady at least 100×10^{-9} sec. prior and after the RDS true period.
- RDS- Read Data Strobe. Will be low for $\pm 1.0 \times 10^{-6}$ sec. indicating that RNZ can be sampled during this period.

Read data in the forward direction will have the preamble removed but will contain all of the postamble. (Therefore, CRCC and postamble must be stripped in forward direction and the CRCC.) The CRCC and the preamble must be removed in the reverse direction. To output read data strobes, a series of 'zeros' and a 'one' must be sensed. A drop-out will disable RDA if it exists for more than 50×10^{-6} sec.

The read data threshold levels are internally set to three different levels depending on the write and motion commands. Read only threshold occurs when running at low speed without writing. Write threshold occurs when writing. Search threshold occurs when running at high speed.

The use of these threshold levels allows for the verification and establishment of the data reliability and margins during the required read-while-write check.

- WDS- Write Data Strobe. The write data strobe is generated within the Encoder/Decoder and is sent out to indicate when the Drive is taking data. The low or true strobe period is $\pm 1.0 \times 10^{-6}$ sec.



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PIN #	SIGNAL	FROM	COMMENTS
1	V24+	POWER SUPPLY	+24VDC
2	V5+	POWER SUPPLY	+5VDC
3	LCOM	POWER SUPPLY	LOGIC COMMON
4	V24-	POWER SUPPLY	-24VDC
5	M.N.C.	N.A.	KEY
6	LCOM	POWER SUPPLY	LOGIC COMMON

TABLE 6.1-2

NOTES:

1. M.N.C. Make no external connection.
2. Logic Common to be tied to corresponding signal at one place (where other commons are tied together) in power supply.
3. Mating connector Part Numbers:
Cannon Part Number: 121-7326-702, connector (1 each)
Cannon Part Number: 11-0238-0091, contacts (5 each)
Cannon Part Number: 225-7301-003, key (1 each)



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6.0 POWER - SIGNAL PIN ASSIGNMENTS

6.1 Power Connections

The power pin assignments for all Drive configurations are shown in Table 6.1-1. Additional power connections for Drives with control and Codec Boards are shown in Table 6.1-2.

Power Supply Pin Assignments

Pin #	Signal	From	Comments
1	M.N.C.	N.A.	Keying Plug
2	V24+	Power Supply	+24VDC
3	V24-	Power Supply	-24VDC
4	M.N.C.	N.A.	Keying Plug
5	SCOM	Power Supply	Servo Common
6	V5+	Power Supply	+5VDC
7	LCOM	Power Supply	Logic Common
8	CCOM	Drive	Chassis Common
9	M.N.C.	N.A.	
10	V24+	Power Supply	+24VDC
11	V24-	Power Supply	-24VDC
12	M.N.C.	N.A.	Keying Plug
13	SCOM	Power Supply	Servo Common
14	V5+	Power Supply	+5VDC
15	LCOM	Power Supply	Logic Common
16	CCOM	Drive	Chassis Common

TABLE 6.1-1

- NOTES: 1. Servo, Logic, and Chassis Common are to be tied together and to ground at one point in power supply.
2. Chassis Common is the physical case of the Drive, Servo Common returns the ± 24 VDC currents and Logic Common returns +5VDC.
3. Mating Connector Part Numbers:
 AMP Part Number 2-86256-2, connector (1 each)
 AMP Part Number 86016-4, contacts (16 each)
 AMP Part Number 86286-1, key plugs (3 each)
 or
 Cannon Part Number 121-7326-10843, connector (1 each)
 Cannon Part Number 11-0238-0091, contacts (13 each)
 Cannon Part Number 225-7301-003, key plugs (3 each)
4. M.N.C. Make no external connections.



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5.3 Signal - Pin Assignments for Drives with Control Boards

Pin#	Signal	From	Comments
2	SLD-	Drive	Selected
4	RDY-	Drive	Ready
6	WND-	Drive	Write Enabled
8	FLG-	Drive	Flag
10	LPS-	Drive	Load Point Sensed
12	FUP-	Drive	File Unprotected
14	BSY-	Drive	Busy
16	EWS-	Drive	Early Warning Sensed
18	RWD-	Controller	Rewind
20	REV-	Controller	Reverse
22	FWD-	Controller	Forward
24	HSP-	Controller	High Speed
26	WEN-	Controller	Write Enable
28	SL1-	Controller	Unit Select 2 ⁰
30	SL2-	Controller	Unit Select 2 ¹
32	SL4-	Controller	Unit Select 2 ²
34	SLG-	Controller	Select Gate
35	DAD-	Drive	Data Detected 2
36	DAD+	Drive	Data Detected 1
39	RDA-	Drive	Read Data 2
40	RDA+	Drive	Read Data 1
43	WDA-	Controller	Write Data 2
44	WDA+	Controller	Write Data 1
46	TR2-	Controller	Track Select 2 ¹
50	TR1-	Controller	Track Select 2 ⁰

TABLE 6.2-1

Note: 1) All other odd numbered pins ($2N-1 \leq N \leq 25$) are returns or grounds.

2) Mating connector is 3M Co. Part Number 3425-3000, or equivalent.



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6.2 Signal - Pin Assignments for Basic Model Drives

Pin #	Signal	From	Comments
1	SL2-	Controller	Select Unit 2
3	SL1-	Controller	Select Unit 1
5	FIP-	Drive	File Protected
7	BLB-	Drive	Bulb
9	LTH-	Drive	Lower Tape Hole
11	CIP-	Drive	Cartridge in Place
13	UTH-	Drive	Upper Tape Hole
15	RDA+	Drive	Read Data 1
16	RDA-	Drive	Read Data 2
17	LCOM	Drive	Logic Common
19	DAD+	Drive	Data Detected 1
20	DAD-	Drive	Data Detected 2
21	LCOM	Drive	Logic Common
23	TR1-	Controller	Track 2 ⁰
25	TR2-	Controller	Track 2 ¹
27	M.N.C.	N.A.	
29	WDA+	Controller	Write Data 1
30	WDA-	Controller	Write Data 2
31	WEN-	Controller	Write Enable
33	M.N.C.	N.A.	
35	FWD-	Controller	Forward
37	REV-	Controller	Reverse
39	HSP-	Controller	High Speed

- Notes:
- 1) All not listed ($2N \leq N \leq 20$) signal lines are the returns or grounds.
 - 2) Mating connector is 3M Co. Part Number 3417-3000 or equivalent.
 - 3) The above refers to Drives without a control board; connections are made directly to interconnect card.
 - 4) M.N.C. Make no external connection.



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7.0 DATA INPUT FORMAT FOR DRIVES WITH CODEC BOARD

7.1 Pre and Postambles

An appended non-data bearing pattern of at least thirty-nine (39) 'zeros' followed by one (1) 'one' shall be added to the beginning of each data block. This pattern is called a preamble. The reverse pattern (i.e., one (1) 'one' followed by at least thirty-nine (39) 'zeros' shall be added to the end of each data block. This pattern is called a postamble. The preamble is stripped from the read data by the drive in the forward mode and the postamble is stripped from the read data in the reverse mode.

Hence, a data block is:

≥ 39 'zeros'; 1 'one', Data, 1 'one', and ≥ 39 'zeros'.

7.2 Check Characters

Any check characters shall be agreed to by the interchanging parties. ANSI CRCC: $X^{16} + X^{15} + X^2 + 1$ is often adopted.

7.3 Minimum Data Block Size

A data block shall contain at least 1024 data bits.

7.4 Tape Mark

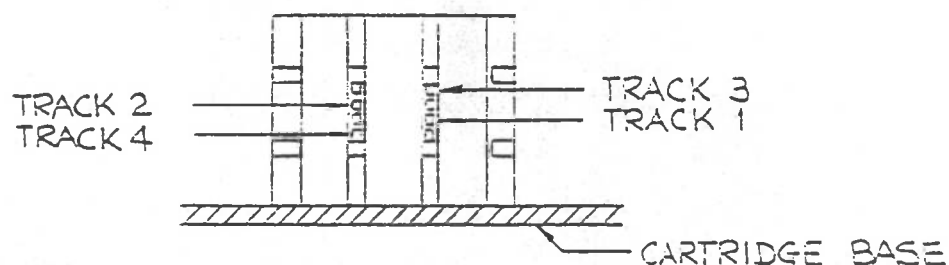
A tape mark shall consist of a preamble, 16 data bits and a postamble.

7.5 The Interblock Gap

The minimum interblock gap (IBG) shall be 1.2 inches. Commanding WEN true will cause the removal (using the Drive AC erase capability) of any recoverable data or spurious transitions from the interblock gap.

7.6 Number of Tracks

There shall be 4 recordable tracks.



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6.4 SIGNAL - PIN ASSIGNMENTS FOR DRIVES WITH A CONTROL AND CODEC BOARD.

PIN #	SIGNAL	FROM	COMMENTS
2	SLD-	Drive	Selected
4	RDY-	Drive	Ready
6	WND-	Drive	Write Enabled
8	FLG-	Drive	Flag
10	LPS-	Drive	Load Point Sensed
12	FUP-	Drive	File Unprotected
14	BSY-	Drive	Busy
16	EWS-	Drive	Early Warning Sensed
18	RWD-	Controller	Rewind
20	REV-	Controller	Reverse
22	FWD-	Controller	Forward
24	HSP-	Controller	High Speed
26	WEN-	Controller	Write Enable
28	SL1-	Controller	Unit Select 2 ⁰
30	SL2-	Controller	Unit Select 2 ¹
32	SL4-	Controller	Unit Select 2 ²
34	SLG-	Controller	Select Gate
36	RNZ-	Drive	Read NRZ Data
38	RDS-	Drive	Read Data Strobe
40	DAD-	Drive	Data Detected
42	WDE-	Controller	Write Data Enabled
44	WNZ-	Controller	Write NRZ Data
46	TR2-	Controller	Track Select 2 ¹
48	WDS-	Drive	Write Data Strobe
50	TR1-	Controller	Track Select 2 ⁰

NOTE: 1) All odd numbered pins are returns.

2) Mating connector: 3M Part Number 3425-3000 or equivalent.



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7.0 DATA INPUT FORMAT FOR DRIVES WITH CODEC BOARD

7.1 Pre and Postambles

An appended non-data bearing pattern of at least thirty-nine (39) 'zeros' followed by one (1) 'one' shall be added to the beginning of each data block. This pattern is called a preamble. The reverse pattern (i.e., one (1) 'one' followed by at least thirty-nine (39) 'zeros' shall be added to the end of each data block. This pattern is called a postamble. The preamble is stripped from the read data by the drive in the forward mode and the postamble is stripped from the read data in the reverse mode.

Hence, a data block is:

≥ 39 'zeros'; 1 'one', Data, 1 'one', and ≥ 39 'zeros'.

7.2 Check Characters

Any check characters shall be agreed to by the interchanging parties. ANSI CRCC: $X^{16} + X^{15} + X^2 + 1$ is often adopted.

7.3 Minimum Data Block Size

A data block shall contain at least 1024 data bits.

7.4 Tape Mark

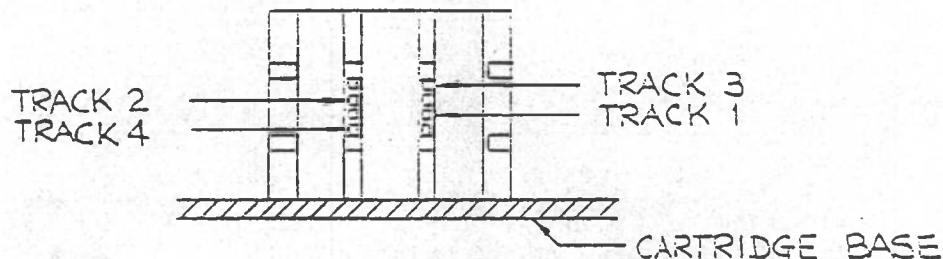
A tape mark shall consist of a preamble, 16 data bits and a postamble.

7.5 The Interblock Gap

The minimum interblock gap (IBG) shall be 1.2 inches. Commanding WEN true will cause the removal (using the Drive AC erase capability) of any recoverable data or spurious transitions from the interblock gap.

7.6 Number of Tracks

There shall be 4 recordable tracks.



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D301224

B

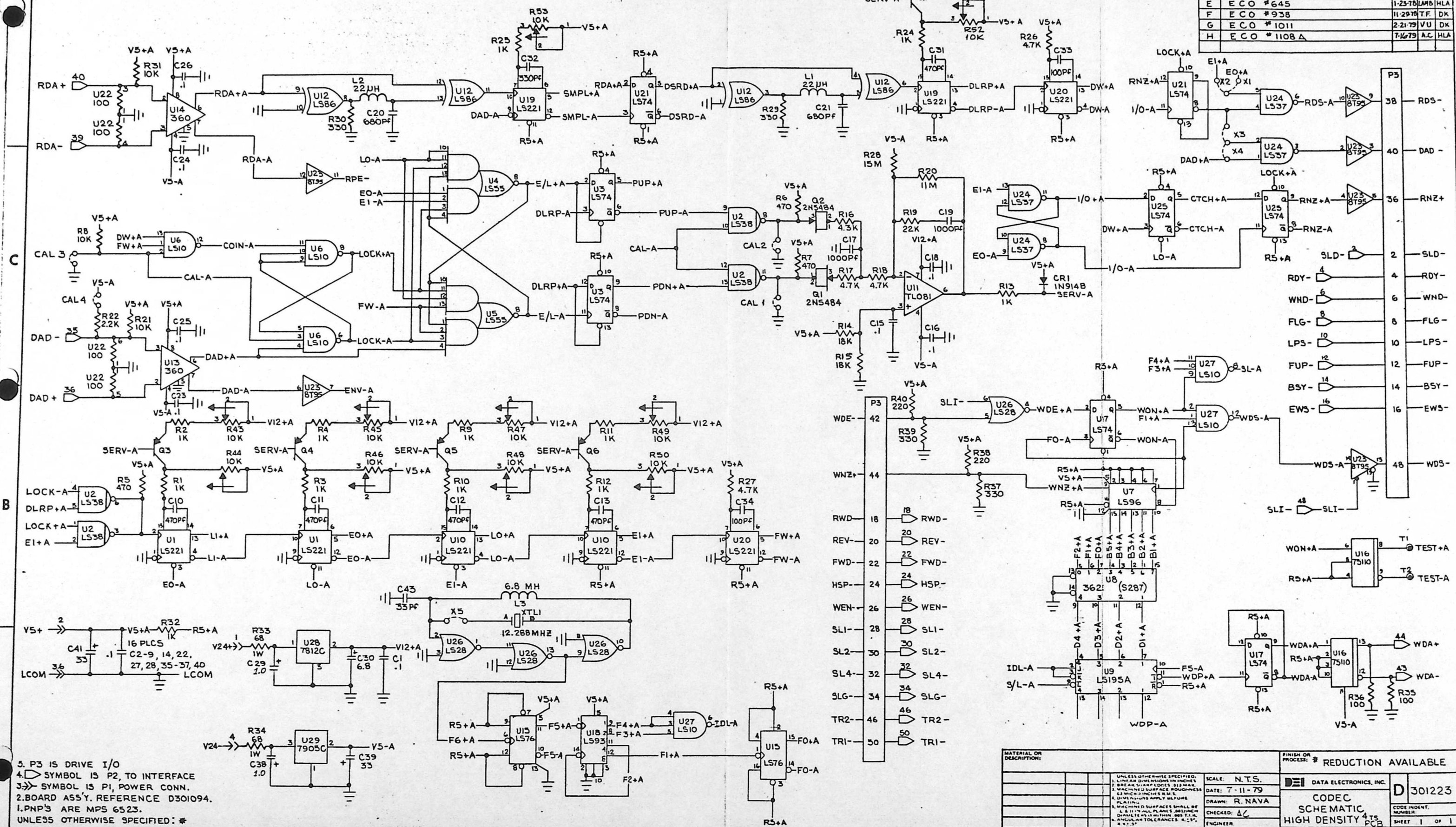
D = .034 - .040 DIA. 33 PLC'S.
C = .040 - .046 DIA. 6 PLC'S.
B = .083 - .090 DIA. 2 PLC'S.

- NOTES 1. COMPONENT SIDE SHOWN.

A

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPD
A	ECO # 619	12-5-77	TF	HLA
B	ECO # 621	12-12-77	TF	HLA
C	ECO # 632	1-11-78	TF	HLA
D	ECO # 636	1-16-78	UHB	HLA
E	ECO # 645	1-23-78	UHB	HLA
F	ECO # 938	11-29-78	TF	DK
G	ECO # 1011	2-21-79	VU	DK
H	ECO # 1108A	7-16-79	AC	HLA

D 301223

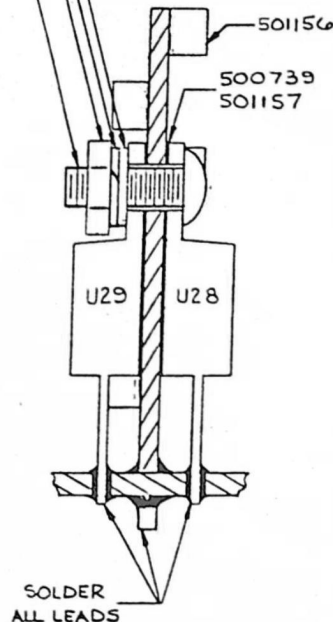


5. P3 IS DRIVE I/O
 4. SYMBOL IS P2, TO INTERFACE
 3. SYMBOL IS P1, POWER CONN.
 2. BOARD ASSY. REFERENCE D301094.
 1. PNP'S ARE MPS 6523.
 UNLESS OTHERWISE SPECIFIED: *

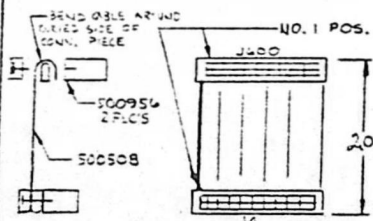
NOTES:

MATERIAL OR DESCRIPTION:		FINISH OR PROCESS: # REDUCTION AVAILABLE	
D301094		D 301223	
NEXT ASSEMBLY		DO NOT SCALE DRAWING	
DATE: 7-11-79		CODEC SCHEMATIC HIGH DENSITY 4TS PCB	
DRAWN: R. NAVA		SHEET 1 OF 1	
CHECKED: AC		THE TECHNICAL DATA AND THE DESIGN DISCLOSED HEREIN ARE THE PROPERTY OF DATA ELECTRONICS, INC. AND ARE NOT TO BE USED BY ANY OTHER PARTY WITHOUT THE WRITTEN CONSENT OF DATA ELECTRONICS, INC.	
ENGINEER:		UNLESS OTHERWISE SPECIFIED: 1. LINEAR DIMENSIONS IN INCHES 2. BREAK VIEW LOCUS 913 HALL 3. MACHINED SURFACE ROUGHNESS 4. DIMENSIONS APPLY UNLESS PLATING 5. MACHINED SURFACES SHALL BE 6. & 11 IN PLANE 0.010 INCH 7. DISTANCE VALUES IN DIMS 8. CAPACITANCE VALUES IN MICROFARADS	
SCALE: N.T.S.		DATE: 7-11-79	
DRAWN: R. NAVA		CODEC SCHEMATIC HIGH DENSITY 4TS PCB	
CHECKED: AC		SHEET 1 OF 1	
ENGINEER:		UNLESS OTHERWISE SPECIFIED: 1. LINEAR DIMENSIONS IN INCHES 2. BREAK VIEW LOCUS 913 HALL 3. MACHINED SURFACE ROUGHNESS 4. DIMENSIONS APPLY UNLESS PLATING 5. MACHINED SURFACES SHALL BE 6. & 11 IN PLANE 0.010 INCH 7. DISTANCE VALUES IN DIMS 8. CAPACITANCE VALUES IN MICROFARADS	

#4-40 X .312L NYLON SCREW
#4-40 HEX NUT, CAD.
#4 SPLIT LOCKWASHER, CAD.
#4 FLATWASHER, CAD.



SEC. A-A



DETAIL B

N.T.S

PI PIN-OUT					
NO.	SIGNAL	NO.	SIGNAL	NO.	SIGNAL
1	V24+	2	V5+	3	LCOM
4	V24-	5	KEY	6	LCOM

M	ECO 938	11-27-78	2K
N	ECO 1011	3-21-79	2K
O	ECO 1105	5-22-79	2K
P	ECO 1108A	7-17-79	2K
Q	ECO 1181	9-25-79	2K
R	ECO 1183	11-25-79	2K
S	ECO 1187	2-19-80	2K

BOARD, 301224

F	ECO # 632	1-11-78	2K
G	ECO # 635	1-13-78	2K
H	ECO # 636	1-10-78	2K
J	ECO # 645	1-23-79	2K
K	E.C.O. # 728	5-1-78	2K
L	ECO # 907	1-10-78	2K

SOCKET, 500447

POST, 500163
8PLCS

D301094

REVISIONS			
LETTER	DESCRIPTION OF CHANGE	DATE	BY
A	ECO # 612	11-27-78	2K
B	ECO # 615	1-27-79	2K
C	ECO # 619	1-25-79	2K
D	ECO # 620	1-25-79	2K
E	ECO # 621	12-2-79	2K



NO POST P1-5

POST, 500163

POST, 500163

SOLDER IN PLACE

SEE NOTES

REDUCTION AVAILABLE

CASE UNTIL TRANSISTOR IS .03 TO .06 FROM BOARD SURFACE.
TO INSTALL Q1-Q7, INSERT LEADS INTO PROPER HOLES THEN PUSH ON P1, P3, X1, X2, CAL1, CAL2, CAL3, CAL4, T1, T2, X3, X4.
INSTALL POST, 500163, WITH LONG END ON COMP. SIDE 71 PLUS TOTAL, 2. SCHEMATIC REF. D301223.
NOTES: 1. COMPONENT SIDE SHOWN.

SIDE AFTER SOLDER, 50 PLUS, P2.
INSTALL POST, 500163, WITH LONG END ON SOLDER.
ASSEMBLY NO. AND CHANGE LEVEL TO BE STAMPED ON SOLDER SIDE.

4/1	10-29-77	T. FRESH	DEL DATA ELECTRONICS INC.	D 301094
10-29-77	T. FRESH	DEL DATA	CODEC ASSEMBLY	HIGH DENSITY, 4TS

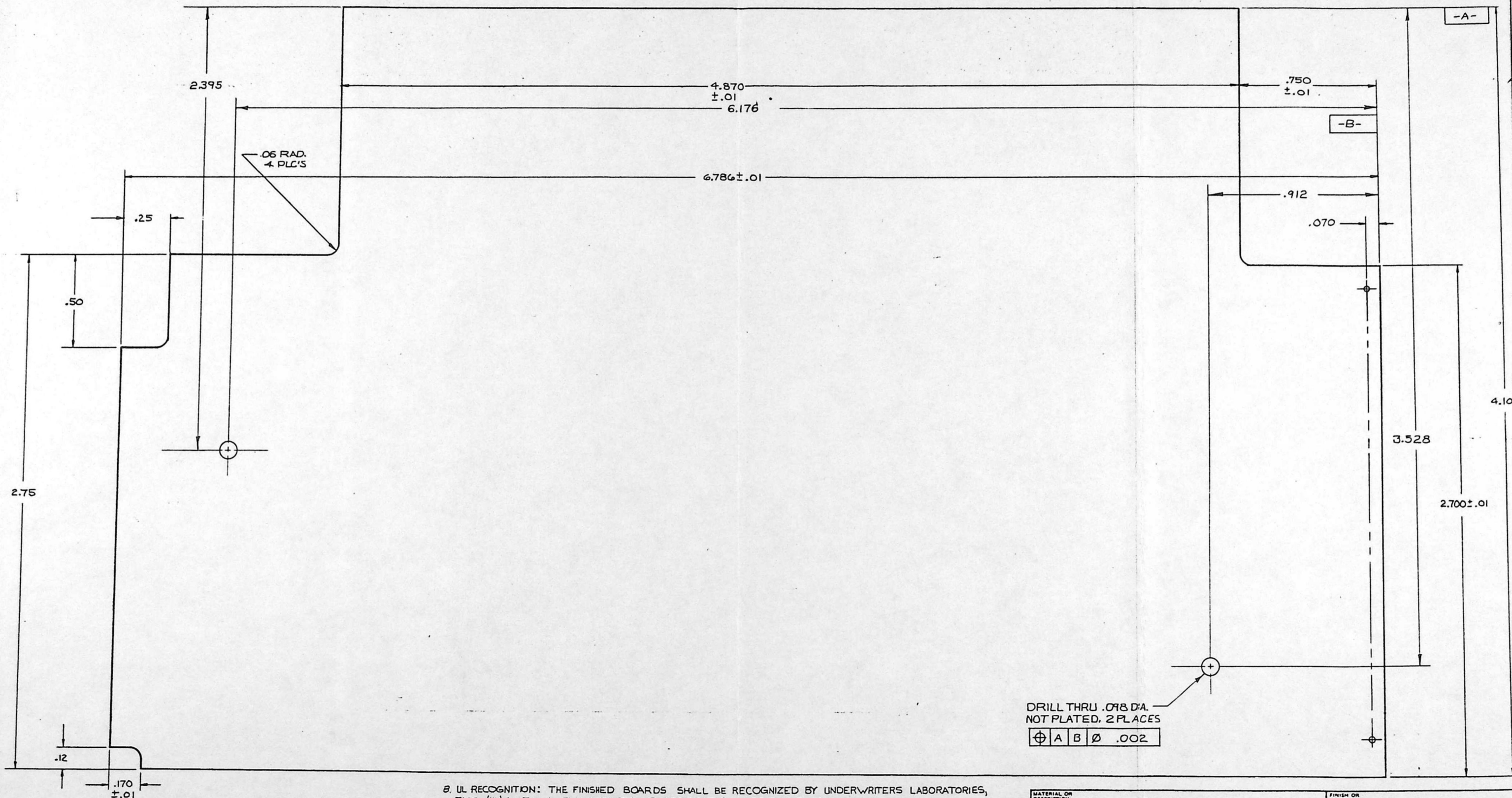
ECO # 1745

11-20-78

6

D301239

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPRO
A	ECO # 907	1-2-78	KA	DK
B	ECO # 988	1-24-78	TF	DK
C1	ECO 1192	10-30-79	LDY	RD
C2	ECO 1502	12-11-79	LDY	DK

DRILL THRU .078 DIA.
NOT PLATED, 2 PLACES

A B Ø .002

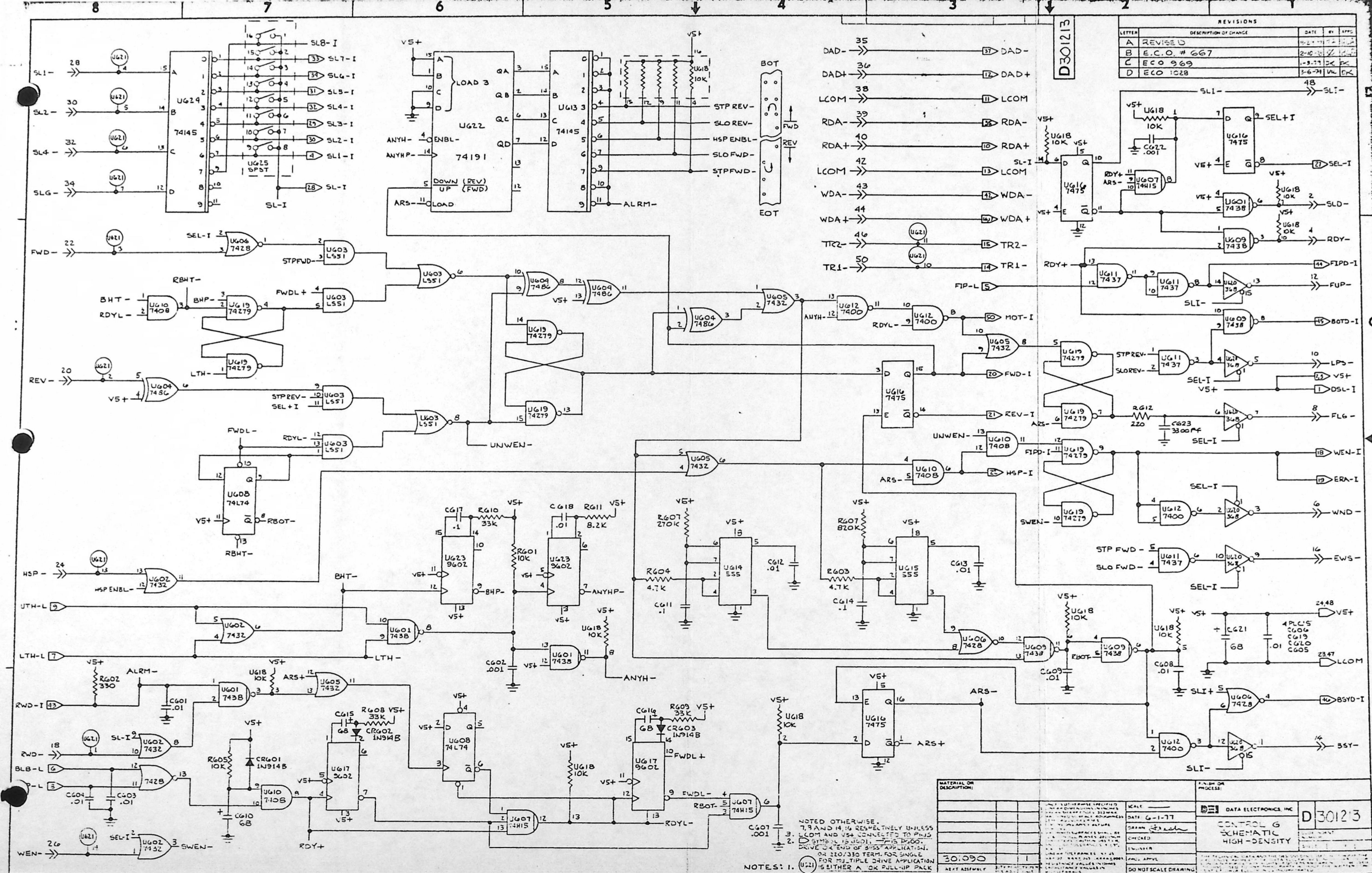
6. ALL HOLES PLATED THRU $\geq .001$ COPPER.
5. NET COPPER (LAMINATE AND PLATING) 30Z/FT².
4. CIRCUITRY FINISH: SOLDER PLATE, 60/40 FUSED.
3. BOARD MATERIAL: FR4 EPOXY GLASS LAMINATE .062 THICK.
(737 PLCS).

NOTES: 1. COMPONENT SIDE SHOWN.
2. ALL HOLES .032-.036 DIA. AFTER PLATING.

8. UL RECOGNITION: THE FINISHED BOARDS SHALL BE RECOGNIZED BY UNDERWRITERS LABORATORIES, INC. (UL) WITH A FLAMMABILITY CLASSIFICATION OF 94V-0. THE BOARDS SHALL BEAR THE MANUFACTURERS IDENTIFICATION AND TYPE NUMBER AS REQUIRED AND AUTHORIZED BY UL TO INDICATE THE FLAMMABILITY CLASSIFICATION. DEI LOCATION APPROVAL IS REQUIRED IF I.D. AND TYPE NO. IS ETCHED.

7. SOLDER MASK BOARDS, USING PAD MASTER, TO BEST COMMERCIAL STANDARDS.

MATERIAL OR DESCRIPTION:		FINISH OR PROCESS: SEE NOTES	
UNLESS OTHERWISE SPECIFIED: 1. LINEAR DIMENSIONS IN INCHES 2. BREAK DIMENSIONS 812 MAX 3. MACHINED SURFACE ROUGHNESS 4. DIMENSIONS APPLY UNLESS 5. MACHINED SURFACES SHALL BE 6. & .01 IN ALL PLACES .001 INCH DIAMETERS WITHIN .005 TYP. 7. ANGULAR TOLERANCES: M: 3°, W: 2.5° 8. LINEAR TOLERANCES: M: .01, W: .02, K: .005, K: .005, K: .005 9. DISTANCE VALUES IN DIMS 10. CAPACITANCE VALUES IN MICRO FARADS		SCALE: 4/1 DATE: 1-26-78 DRAWN: T. FRESH CHECKED: HLA. ENGINEER: PROJ. APPL: DO NOT SCALE DRAWING	DEI DATA ELECTRONICS, INC. CONTROL G FABRICATION HIGH-DENSITY THE TECHNICAL DATA AND THE DESIGN DISCLOSED HEREIN ARE THE EXCLUSIVE PROPERTY OF DATA ELECTRONICS, INC. AND ARE NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS WITHOUT THE WRITTEN CONSENT OF DATA ELECTRONICS, INC.
D301090	1	1	D 301239
NEXT ASSEMBLY	QTY PER QTY	REV	CODE IDENT NUMBER SHEET 1 OF 1

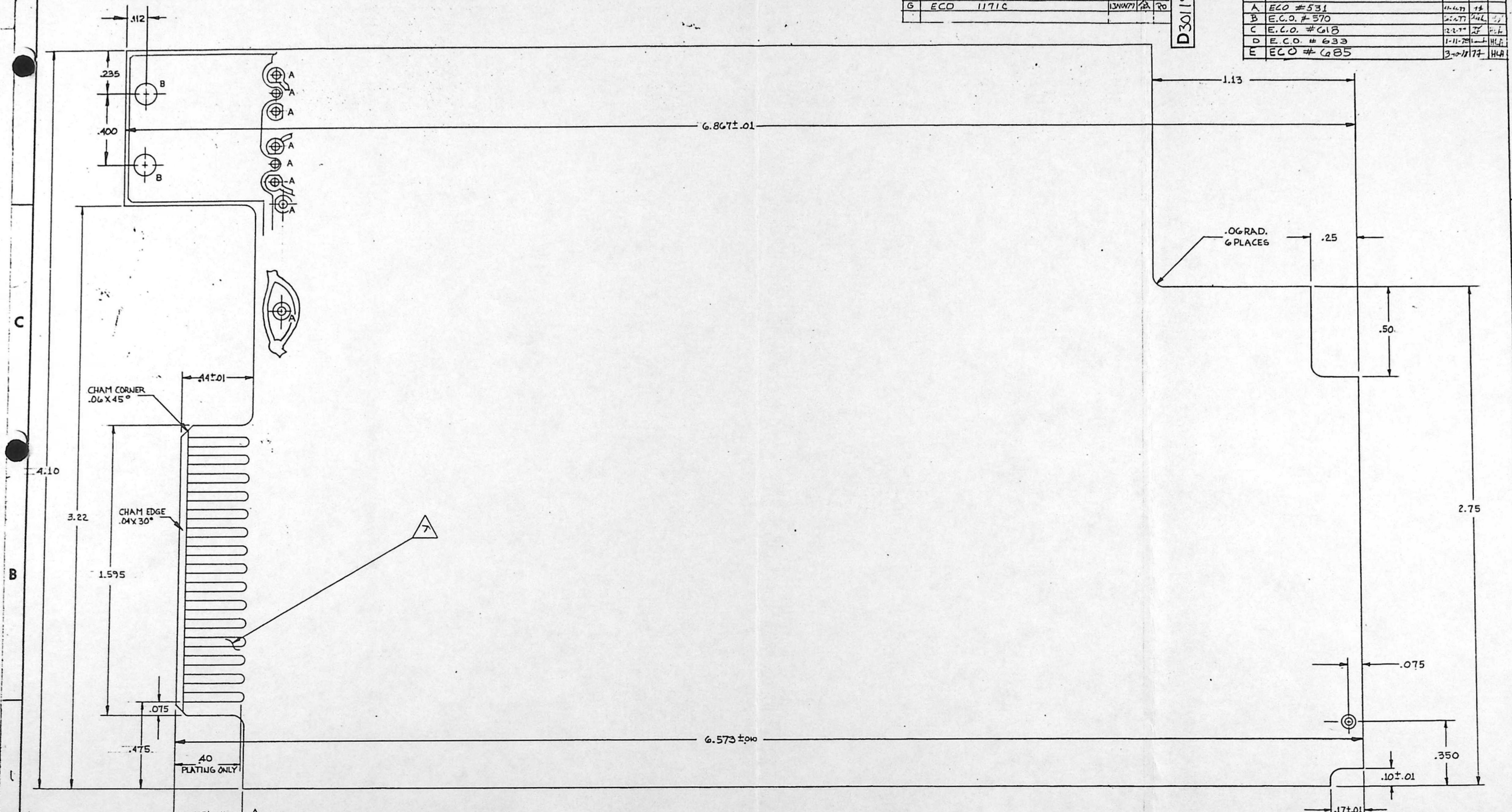


8 7 6 5 4 3 2 1

F	E.C.O.	#907	11-2-77	KA	DKC
F	ECO	1181	9-21-79	RA	RD
G	ECO	1171C	13-11-77	RA	RD

D301192

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPD
A	ECO #531	11-4-77	1#	
B	E.C.O. #570	10-2-77	HLA	
C	E.C.O. #618	2-2-78	HLA	
D	E.C.O. #633	1-11-78	HLA	
E	ECO #685	3-10-77	HLA	

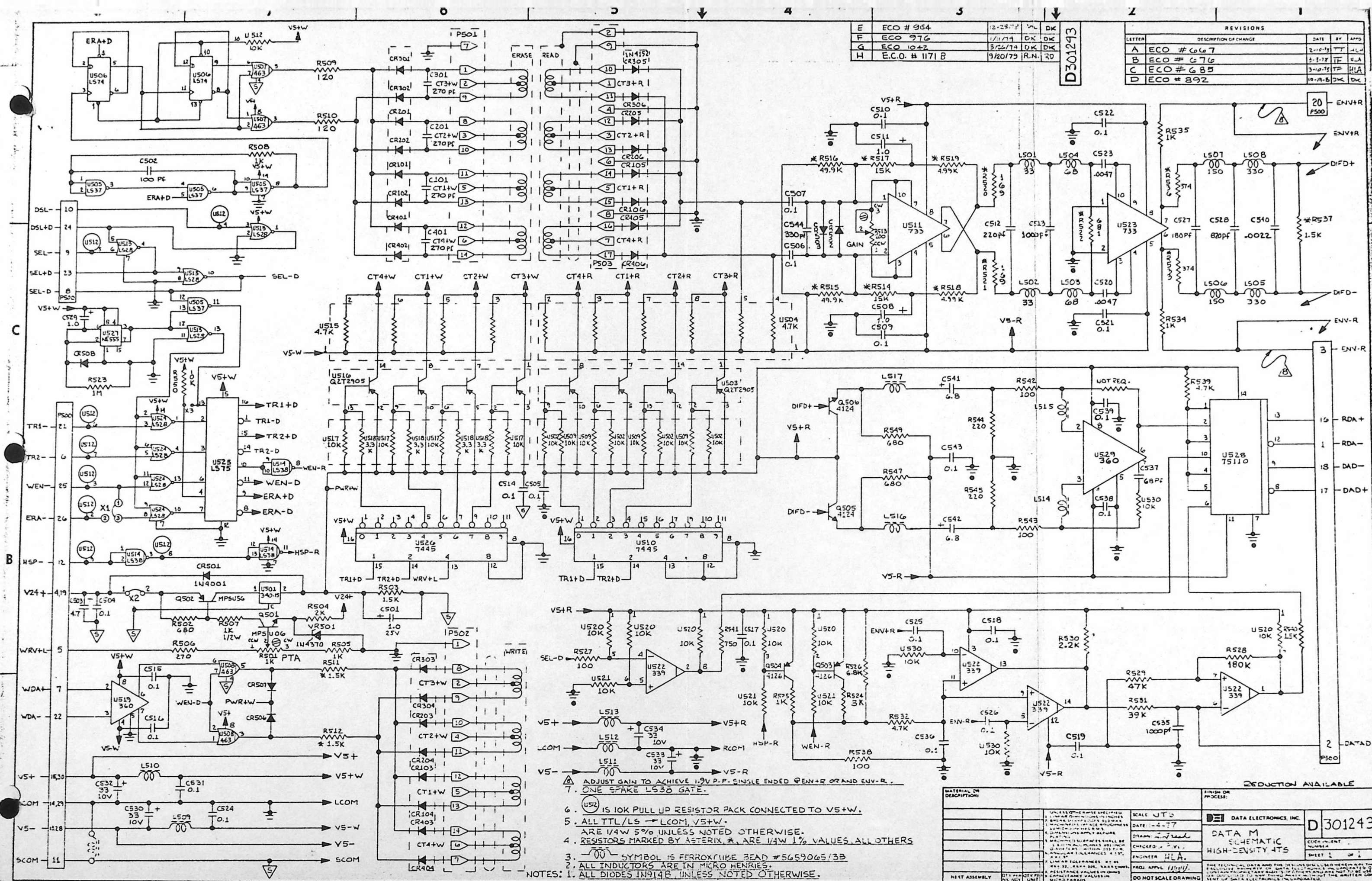


- NOTES:
1. ALL HOLES .031-.045 DIA. 8 PLCS. EXCEPT A=.039-.045 DIA. 8 PLCS. B=.120-.126 DIA. 2 PLCS.
 2. BOARD MATERIAL: FR4 EPOXY GLASS LAMINATED .062 THICK.
 3. CIRCUITRY FINISH: SOLDER PLATE - 60/40 FUSED.
 4. NET COPPER (LAMINATE AND PLATING) 3 OZ / FT².
 5. ALL HOLE DIMENSIONS AFTER PLATING.
 6. ALL PLATED THRU HOLES ≥ .001 COPPER.

9. UL RECOGNITION: THE FINISHED BOARDS SHALL BE RECOGNIZED BY UNDERWRITERS LABORATORIES INC. (UL) WITH A FLAMMABILITY CLASSIFICATION OF 94-V0. THE BOARDS SHALL BEAR THE MANUFACTURERS IDENTIFICATION AND TYPE NUMBER AS REQUIRED AND AUTHORIZED BY UL TO INDICATE THE FLAMMABILITY CLASSIFICATION. DEI LOCATION APPROVAL IS REQUIRED IF I.D. AND TYPE NO. IS ETCHED.

8 SOLDER MASK BOARDS, USING PAD MASTER, TO THE BEST COMMERCIAL STANDARD, BOTH SIDES.

MATERIAL OR DESCRIPTION:		FINISH OR PROCESS:	
UNLESS OTHERWISE SPECIFIED: 1. LINEAR DIMENSIONS IN INCHES 2. BREAK SHARP CORNERS 90° MAX. 3. MACHINED SURFACE ROUGHNESS 32 MICROINCHES R.M.S. 4. DIMENSIONS APPLY BEFORE PLATING 5. MACHINED SURFACES SHALL BE .001 IN ALL PLACES, 80 MICROINCH DIAMETERS 5 WITHIN .005 T.I.R. 6. ANGULAR TOLERANCES: ±15°, 30°, 45°		SCALE: 4/1 DATE: 1-17-77 DRAWN: JF CHECKED: JF ENGINEER: PROJ. APPV: JF DO NOT SCALE DRAWING	
D301086 D301061 NEXT ASSEMBLY		DEI DATA ELECTRONICS, INC. DATA J, M FABRICATION CODE IDENT. NUMBER SHEET 1 OF 4 THE TECHNICAL DATA AND THE DESIGNS DISCLOSED HEREIN ARE THE EXCLUSIVE PROPERTY OF DATA ELECTRONICS INCORPORATED OR CONTAIN PROPRIETARY RIGHTS OF OTHERS AND ARE NOT TO BE USED OR DISCLOSED TO ANY THIRD PARTY WITHOUT THE WRITTEN CONSENT OF DATA ELECTRONICS INCORPORATED.	



REDUCTION AVAILABLE

FINISH ON PROCESS:		REDUCTION AVAILABLE	
 DATA ELECTRONICS, INC.		 301243	
DATA M SCHEMATIC HIGH-DENSITY HTS		CHECK INVENT NUMBER SHEET 1 OF 1	
THE TECHNICAL DATA AND THE DESIGN DATA USED HEREIN ARE THE PROPERTY OF DATA ELECTRONICS, INC. AND ARE NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN CONSENT OF DATA ELECTRONICS, INC.			

N ECO # 1672

10-15-83 42

M ECO #1171C

11-21-79 RNRD

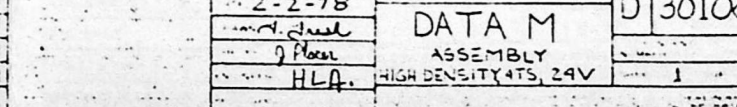
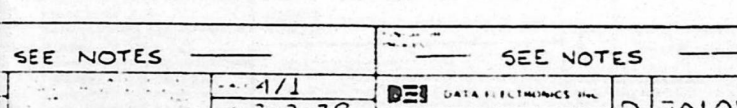
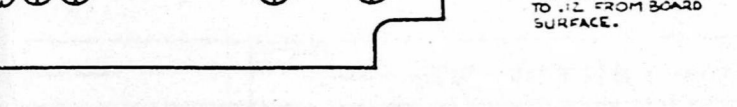
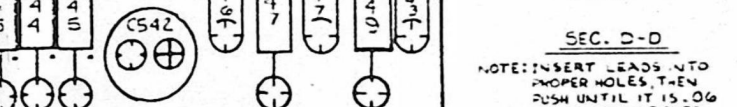
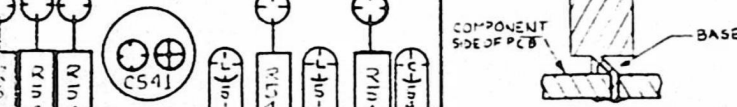
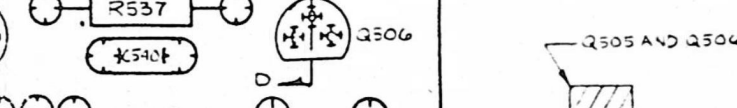
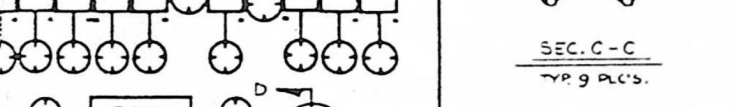
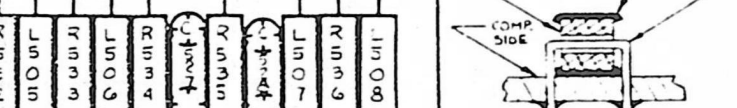
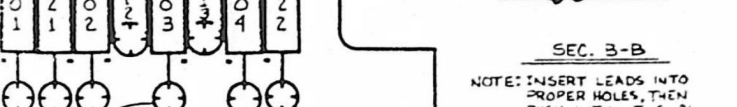
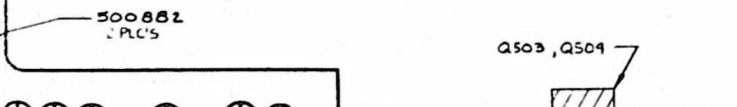
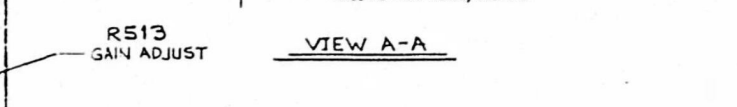
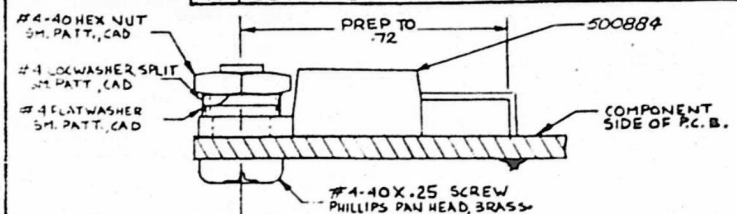
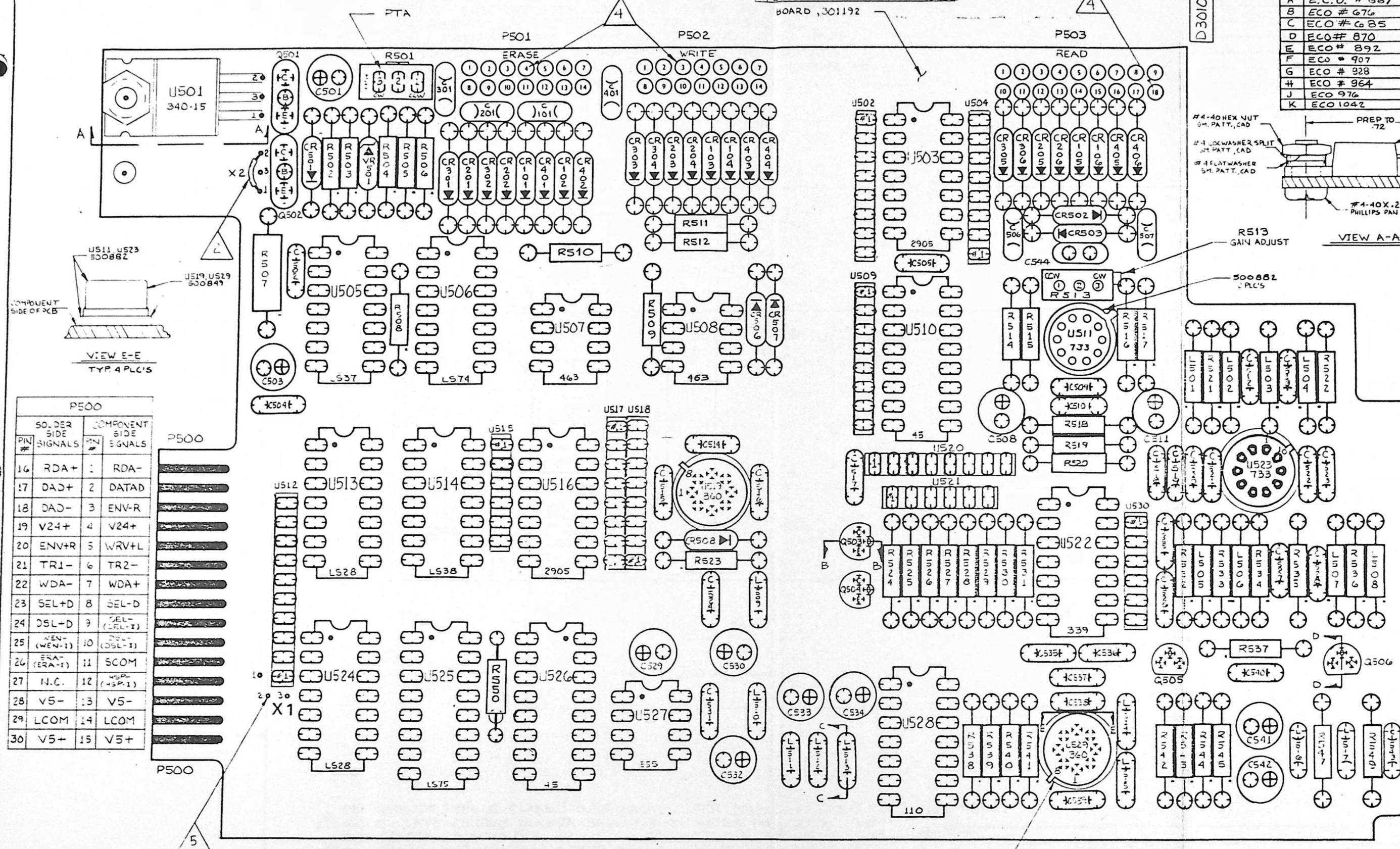
L ECO # 1166A

12-11-79 KA

D301086

REVISIONS

LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPD
A	E.C.O. # 667	2-10-78	SL	HLA
B	ECO # 676	3-5-78	ZF	HLA
C	ECO # 685	3-13-79	17	HLA
D	ECO # 870	10-11-78	AL	HLA
E	ECO # 892	10-11-78	DK	HLA
F	ECO # 907	1-24-79	KA	DK
G	ECO # 928	1-28-79	IN	DK
H	ECO # 964	12-28-79	HL	DK
J	ECO 976	1/11/81	DK	DK
K	ECO 1042	3/25/81	DK	UK

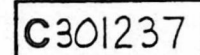


- ON COMPONENT SIDE AND INSTALL JUMPER, X1, BETWEEN 2 AND 3.
WHEN UTILIZING A SEPARATE ERASE FUNCTION, CUT LAND BETWEEN 1 AND 3.
AND POSITION 18, P503.
- COMPONENT SIDE, DO NOT POST POSITIONS 4, P501, 3, P502.
- INSTALL POSTS, 300163, TOTAL OF 43 PLCS, WITH LONG END ON
SIGNAL NAMES IN PARENTHESES, P500, ARE FOR DRIVES WITH INTERFACE.
- INSTALL INSULATED JUMPER X2, FROM 1 TO 2 AS SHOWN.
- NOTES: 1. COMPONENT SIDE SHOWN.

7. ASSEMBLE PER PROCEDURE A301343D
6. SCHEMATIC REFERENCE D301243

SEE NOTES	SEE NOTES
4/1	DATA M
2-2-78	ASSEMBLY
HLA	HIGH DENSITY 4TS, 24V
301091	1 1
301086	1 1

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APP
A	E.C.O. #907	11-3-78	KA	CK

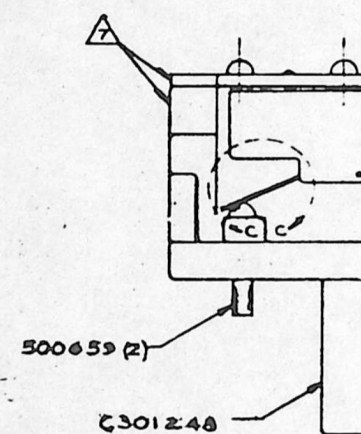
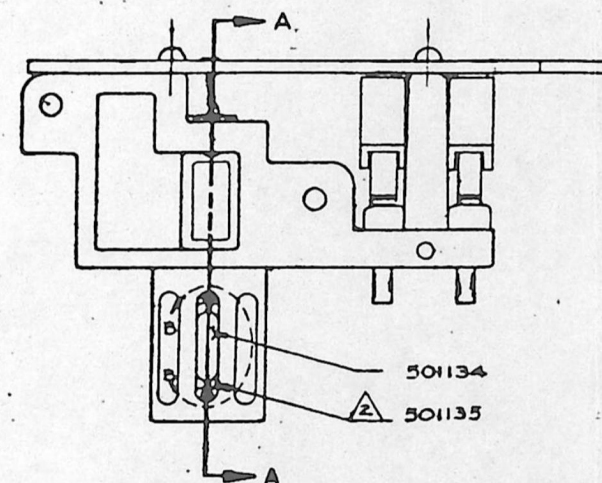
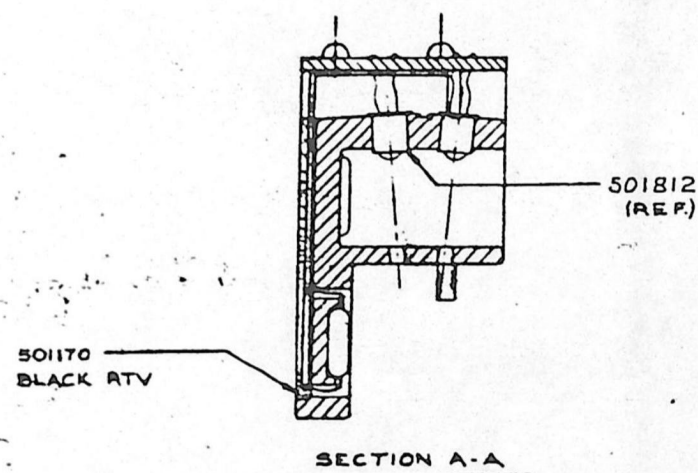
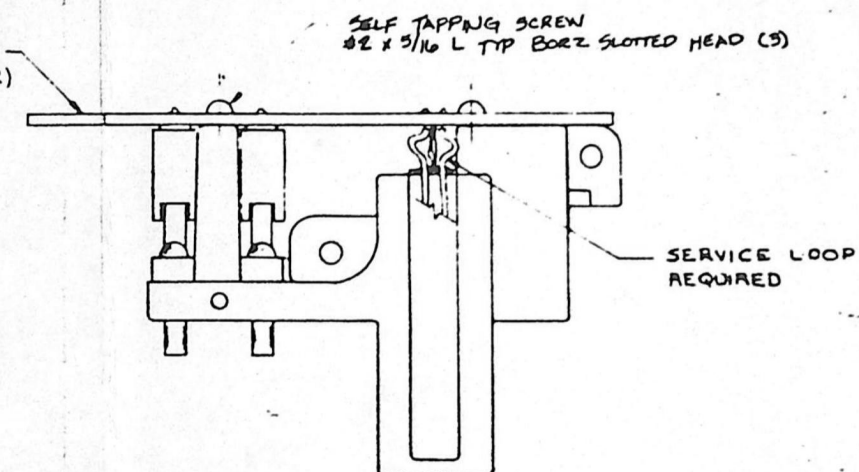


- NOTES:

MATERIAL OR DESCRIPTION:			— SEE NOTES —			FINISH OR PROCESS:			— SEE NOTES —			
			UNLESS OTHERWISE SPECIFIED: 1. LINEAR DIMENSIONS IN INCHES 2. BREAK SHARP EDGES .010 MAX. 3. MACHINED SURFACE ROUGHNESS 63 MICRO-INCHES R.M.S. 4. DIMENSIONS APPLY BEFORE PLATING 5. MACHINED SURFACES SHALL BE 1 & 11 IN ALL PLANES .001 INCH DIAMETERS 0 WITHIN .005 T3.R. 6. ANGULAR TOLERANCES: X+.5°, X-X+.5° 7. LINEAR TOLERANCES: X±.01 .XX±.02, .XXX±.005, .XXXX±.0005; 8. RESISTANCE VALUES IN OHMS 9. CAPACITANCE VALUES IN			SCALE: 4/1 DATE: 1-18-78 DRAWN: T.FRESH CHECKED: HLA ENGINEER: PROJ. APPVL: DO NOT SCALE DRAWING			 DATA ELECTRONICS, INC. SENSOR D FABRICATION		C 301237 CODE IDENT. NUMBER: SHEET 1 of 4	
D301096									THE TECHNICAL DATA AND THE DESIGNS DISCLOSED HEREIN ARE THE EXCLUSIVE PROPERTY OF DATA ELECTRONICS INCORPORATED OR CONTAIN PROPRIETARY RIGHTS OF OTHERS AND ARE NOT TO BE USED OR DISCLOSED TO ANY THIRD PARTY WITHOUT THE WRITTEN CONSENT OF DATA ELECTRONICS INCORPORATED.			
NEXT ASSEMBLY			QTY. PER			QTY. PER						

D301096

ITEM	DESCRIPTION	DATE	BY	APP'D
A	ECO # 772	6/27/78	JA	
B	ECO # 826	7/10/78	JA	
C	ECO # 107	10/15/78	JA	DK
D	ECO # 923	11/20/78	JA	
D	ECO # 1074 (DOCUMENT CHG ONLY)	1/17/79	JA	DK
D	ECO 1203 DOCUMENT CHG.	10/25/79	EA	RD
D	ECO 1243	7/10/79	JA	RD
E	ECO 13524	2/1/80	JA	RD
F	ECO # 1385A	2/1/80	LS	RD

BOARD ASS'Y
(SEE SHEET 2)

NOTES: 1. ASSEMBLY PER PROCEDURE A300552

2. INSTALL REFLECTIVE TAPE 3/32 x 3/8

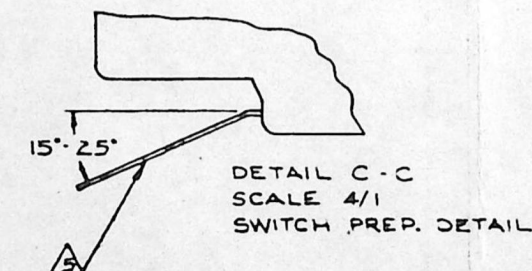
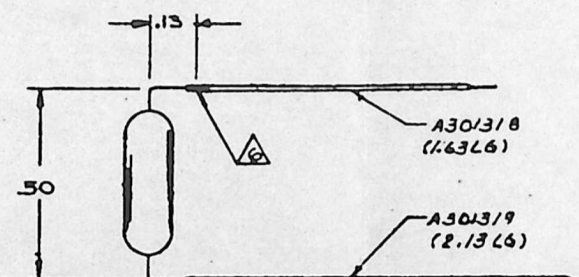
3. OBSOLETE.

4. ALL SCREWS & WASHERS - CADMIUM PLATED

5. BEND SWITCH CONTACT AS REQUIRED

6. SOLDER WIRE LEADS AS SHOWN.

7. BOARD TO BE MOUNTED FLUSH WITH BOTTOM OF SENSOR BLOCK.



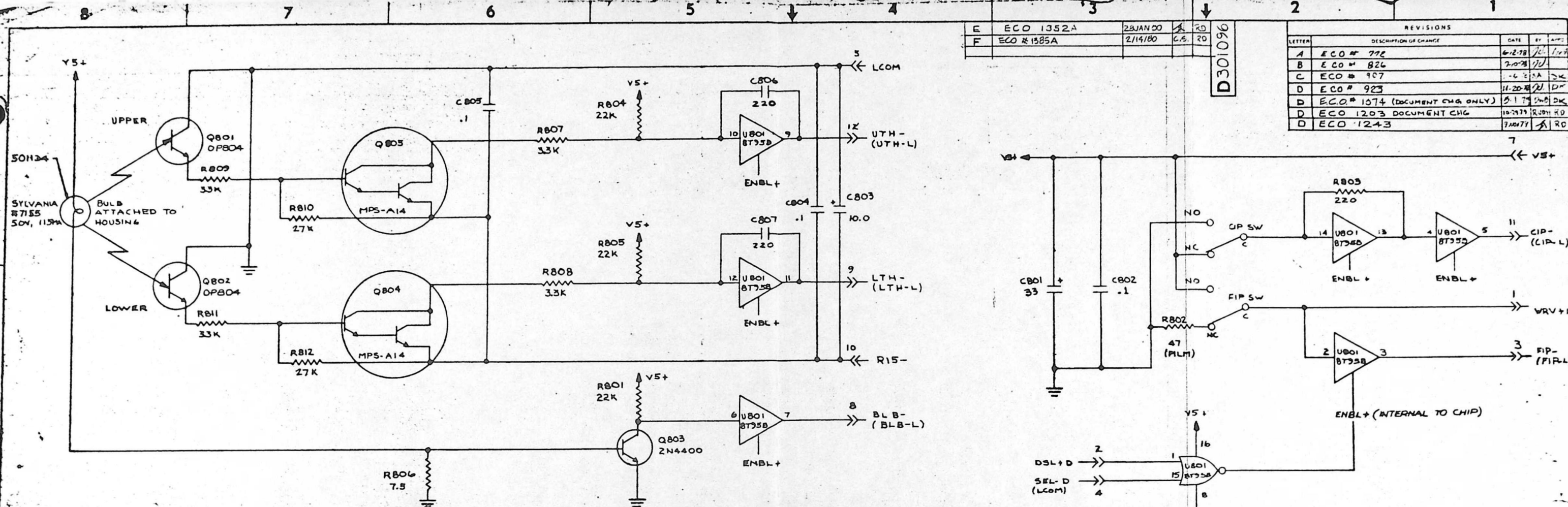
ITEM	DESCRIPTION	DATE	BY	APP'D
D301024	D301010	1	1	
D301027	D301057	1	1	
D301034	D301081	1	1	
D301037	D301084	1	1	
D301048	D301085	1	1	
D301048-2	D301081	1	1	
D301053	D301081	1	1	

---SEE NOTES---

ITEM	DESCRIPTION	DATE	BY	APP'D
D301024	D301010	1	1	
D301027	D301057	1	1	
D301034	D301081	1	1	
D301037	D301084	1	1	
D301048	D301085	1	1	
D301048-2	D301081	1	1	
D301053	D301081	1	1	

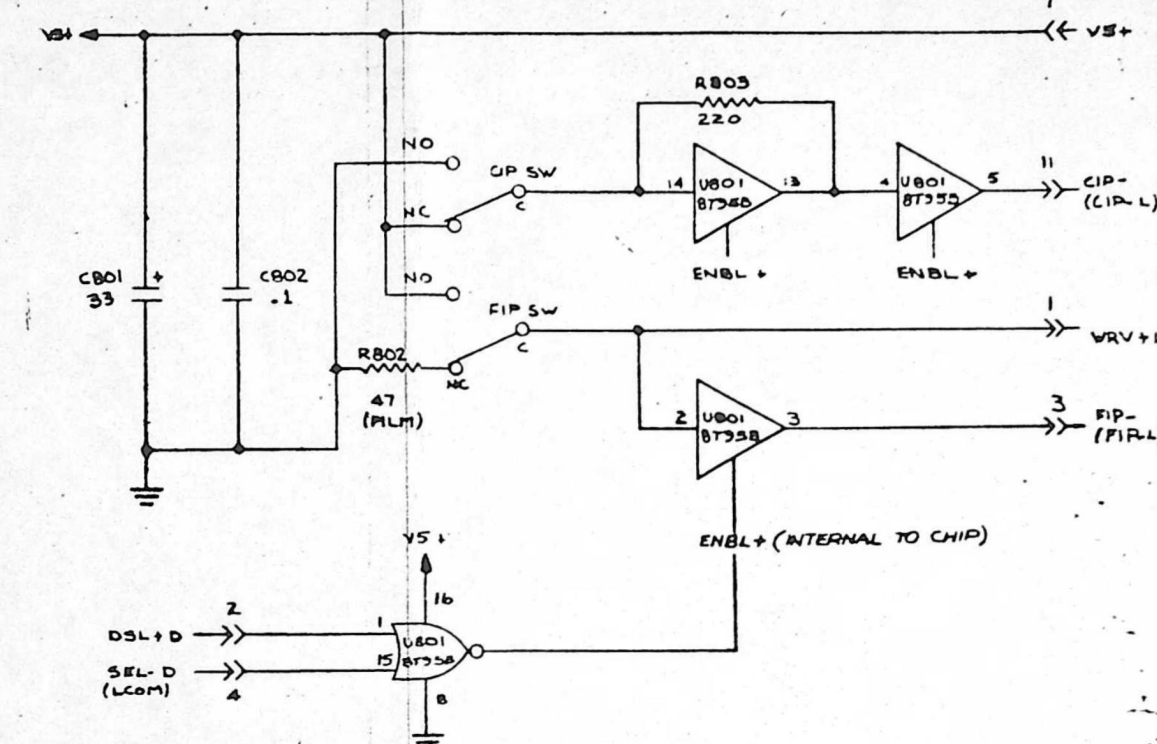
---SEE NOTES---

SCALE 2/1	DATE 2-3-78	DRN LAMP	UNLESS HLT	ENGINEER	PROJ. APPR.	DO NOT SCALE DRAWING
DATA ELECTRONICS INC.						D301096
SENSOR 3						
ASSEMBLY 1						
SCHEMATIC						

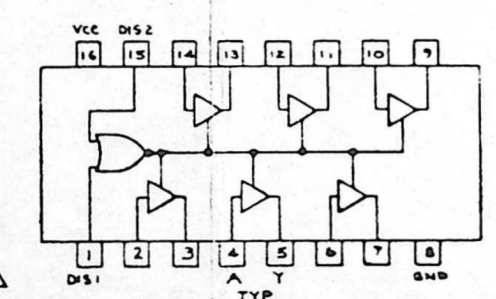
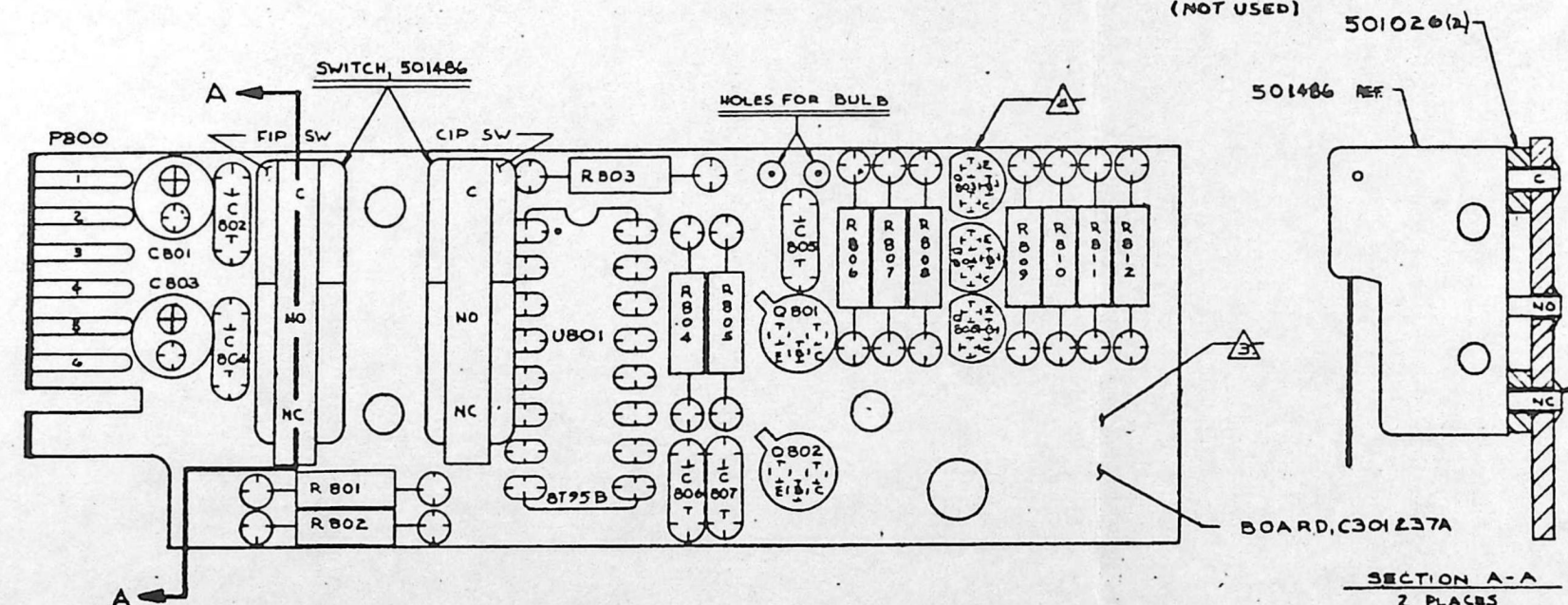


ECO		DATE	BY	REVISIONS
E	ECO 1352A	28JAN 80	RD	
F	ECO 1385A	2/14/80	RD	

LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPROVED
A	ECO # 772	6-12-78	RD	
B	ECO # 826	7-10-78	RD	
C	ECO # 907	1-6-79	RD	
D	ECO # 923	11-20-79	RD	
D	ECO # 1074 (DOCUMENT CHG ONLY)	5-1-79	RD	
D	ECO 1203 DOCUMENT CHG	10-21-79	RD	
D	ECO 1243	7-10-79	RD	



SOLDER SIDE	COMP SIDE
7 V5+	1 WRV+L
8 BLB-	2 DSL+D
9 LTH-	3 FIP-
10 RI5-	4 SEL-D
11 CIP-	5 LCOM
12 UTH-	6 V5-



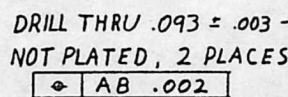
INPUT	OUTPUT
1 15 A	Y
2 14 X	Z
3 13 Y	Z
4 12 H	H
5 11 L	L

- DO NOT IMMERSION CLEAN AFTER SWITCH ASS'Y 1. USE NO FLUX TO SOLDER SWITCHES.
- TO MOUNT Q803, 804 & 805, INSERT LEADS INTO PROPER HOLES & PUSH UNTIL CASE IS .04 TO .08 FROM BOARD SURFACE.
- ASSEMBLY NO. AND CHANGE LEVEL MAY BE PLACED IN THIS AREA ON SOLDER SIDE.
- SIGNAL NAMES IN PARENTHESES ARE FOR DRIVES WITH INTERFACE.

MATERIAL OR DESCRIPTION		SEE NOTES	DATE	BY	PROCESS	SEE NOTES
D301048-2	D301043	1	1			
D301058	D301037	1	1			
D301054	D301034	1	1			
D301061	D301027	1	1			
D301084	D301024	1	1			
D301055	D301010	1	1			

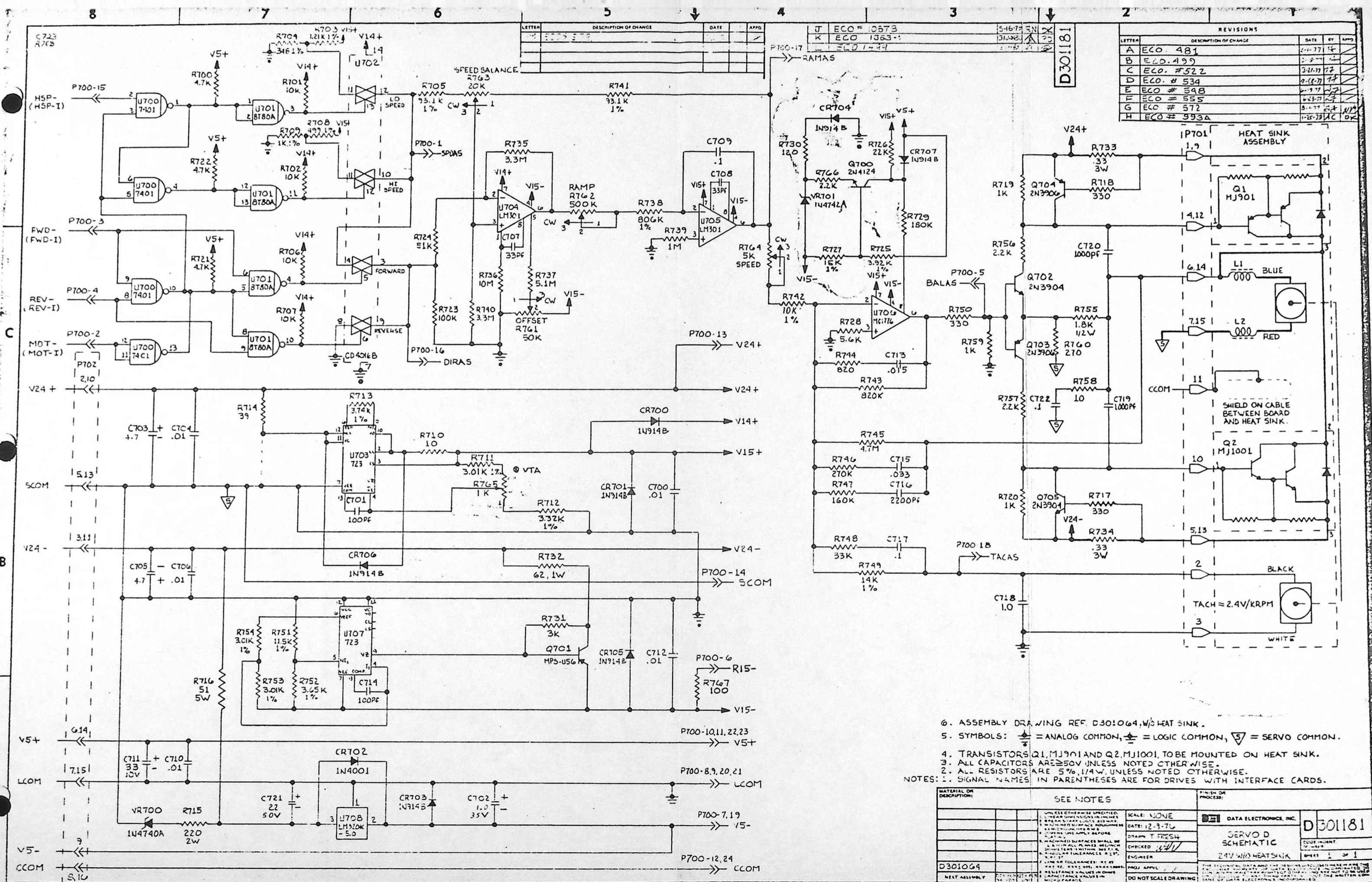
SCALE: 4:1		DATE: 1-20-78		DRAWN BY: HLD		CHECKED BY: HLD		APPROVED BY: HLD	
SENSOR D ASSEMBLY + SCHEMATIC					D 301096				

D301182

D301182

- NOTES: 1. COMPONENT SIDE SHOWN

[illegible]



LETTER	DESCRIPTION OF CHANGE	DATE	APPRO.
J	ECO # 10573	5-16-79	EN
K	ECO # 1363-1	3-1-82	EN
L	ECO # 1-24	1-24-82	EN

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPRO.
A	ECO # 481	2-1-77	EN	
B	ECO # 499	2-3-77	EN	
C	ECO # 522	3-1-77	EN	
D	ECO # 534	4-18-77	EN	
E	ECO # 548	5-1-77	EN	
F	ECO # 555	5-23-77	EN	
G	ECO # 572	5-1-77	EN	
H	ECO # 593A	1-25-79	AC	DK

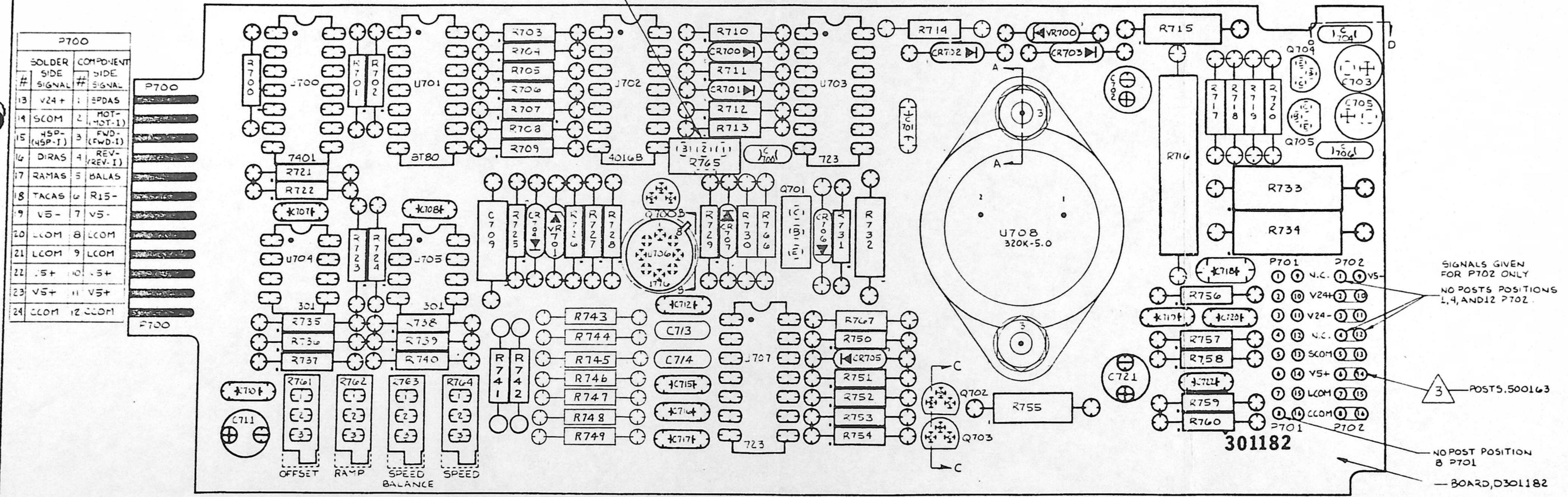
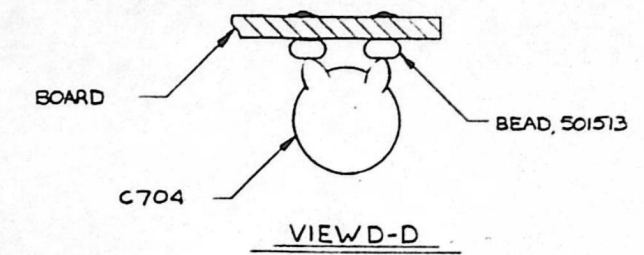
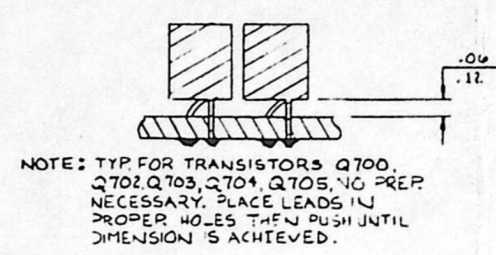
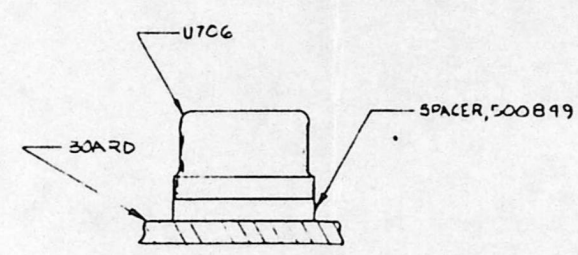
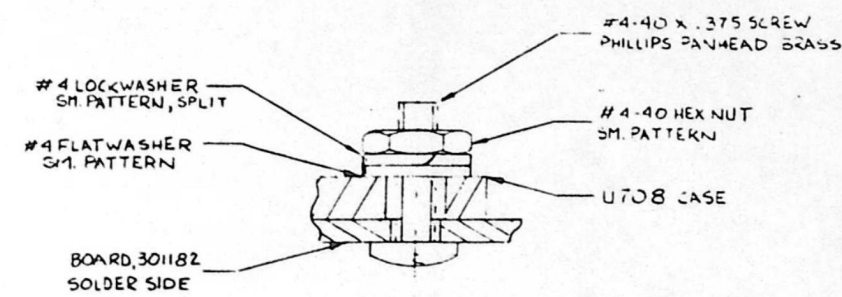
6. ASSEMBLY DRAWING REF. D301064, W/3 HEAT SINK.
5. SYMBOLS: ∇ = ANALOG COMMON, ∇ = LOGIC COMMON, ∇ = SERVO COMMON.
4. TRANSISTORS Q1, MJ901 AND Q2, MJ1001, TO BE MOUNTED ON HEAT SINK.
3. ALL CAPACITORS ARE 50V UNLESS NOTED OTHERWISE.
2. ALL RESISTORS ARE 5%, 1/4W, UNLESS NOTED OTHERWISE.
- NOTES: 1. SIGNAL NAMES IN PARENTHESES ARE FOR DRIVES WITH INTERFACE CARDS.

MATERIAL OR DESCRIPTION	SEE NOTES	FINISH OR PROCESS
D301064	UNLESS OTHERWISE SPECIFIED: 1. ALL DIMENSIONS ARE IN INCHES 2. BREAKS IN DIMENSIONS ARE SHOWN BY DASHES 3. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 4. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 5. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 6. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 7. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 8. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 9. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE 10. DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE	SCALE: NONE DATE: 12-9-76 DRAWN: T. FRESH CHECKED: [Signature] ENGINEER: [Signature] PROJ. APPROV: [Signature] DO NOT SCALE DRAWING
D301064		DATA ELECTRONICS, INC.
SERVO D SCHEMATIC		D301181
2.4V W/3 HEAT SINK		SHEET 1 OF 1

S	ECO #765	1-1-77	AC	DK
T	ECO #800	1-1-77	AC	DK
U	ECO #993A	1-25-77	AC	DK
V	ECO #1037B	1-16-77	EN	DK
W	ECO #1181	9-21-79	EN	DK
X	ECO #1363-1	10-18-79	EN	DK
Y	ECO #1443	1-13-80	EN	DK
Z	ECO #1499	3-25-80	EN	DK

D301064

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPD
A	ECO # 480	2-1-77	12	
B	ECO # 481	2-1-77	12	
C	ECO # 499	4-15-77	12	
D	ECO # 522	5-25-77	12	
E	ECO # 534	11-17-77	12	
F	ECO # 548	4-15-77	12	
G	ECO # 555	5-25-77	12	
H	ECO # 556	7-25-77	12	
J	ECO # 570	1-1-77	12	
K	ECO # 572	1-1-77	12	
L	ECO # 604	1-1-77	12	
M	ECO # 620	1-1-77	12	
N	ECO # 633	1-1-77	12	
P	ECO # 684	3-6-78	12	
R	ECO # 751	5-26-78	12	



P700			
#	SOLDER SIDE SIGNAL	COMPONENT SIDE SIGNAL	#
13	V24+	1	SPDAS
14	SCOM	2	MOT- (MOT-1)
15	HSP- (HSP-1)	3	FWD- (FWD-1)
16	DIRAS	4	REV- (REV-1)
17	RAMAS	5	BALAS
18	TACAS	6	R15-
19	V5-	7	V5-
20	LCOM	8	LCOM
21	LCOM	9	LCOM
22	V5+	10	V5+
23	V5+	11	V5+
24	LCOM	12	LCOM

SIGNALS GIVEN FOR P702 ONLY
NO POSTS POSITIONS 1, 4, AND 12 P702

POSTS 5, 500163

NO POST POSITION 8 P701

BOARD, D301182

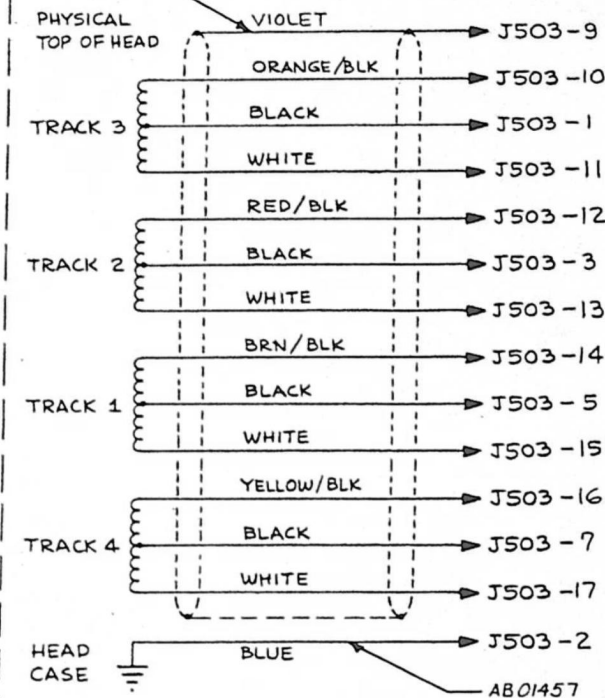
5. SCHEMATIC REFERENCE D301181.
 4. ASSEMBLY PROCEDURE A301321-C
 3. INSTALL POST, 500163, G P701 AND P702 WITH LONG END ON SOLDER SIDE, 28 PLCS.
 2. SIGNAL NAMES IN PARENTHESSES ARE FOR DRIVES WITH INTERFACE BOARDS.
- NOTES: 1. COMPONENT SIDE SHOWN.

SEE NOTES		SEE NOTES	
SCALE 4/1	DATE 12-22-76	DATA ELECTRONICS INC	D 301064
DESIGNED T. FRESH	ENGINEER	SERVO D ASSEMBLY	24V W/O HEATSINK
PROJ. APPR. 1/1	DO NOT SCALE DRAWING		

D301060

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPRO
A	ECO # 1116A	7-15-77	KA	
A	ECO # 1145 DOC. ONLY	8-25-77	KA	
B	ECO 1449	11-17-77	KA	
C	INC ECO #1527	7/10/80	CM	

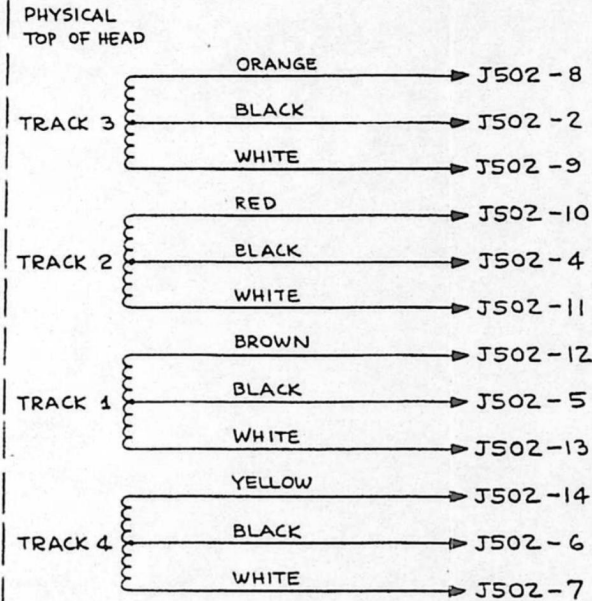
READ SCHEMATIC & WIRE LIST



READ CONNECTOR WIRE LIST-J503				
PIN	COLOR	DESCRIPTION	CUT LENGTH	
1	O	3-C.T.		
2	G	HEAD CASE		
3	O	2-C.T.		
4	N.C.	N.C.		
5	O	1-C.T.		
6	N.C.	N.C.		
7	O	4-C.T.		
8	N.C.	N.C.		
9	7	SHIELD		
10	3/O	3-φ2		
11	9	3-φ1		
12	2/O	2-φ2		
13	9	2-φ1		
14	1/O	1-φ2		
15	9	1-φ1		
16	4/O	4-φ2		
17	9	4-φ1		
18	N.C.	KEY		

ALL LEADS OF EACH TRACK TWISTED IN TRIPLETS WITH MIN. OF 4 TWISTS PER INCH.

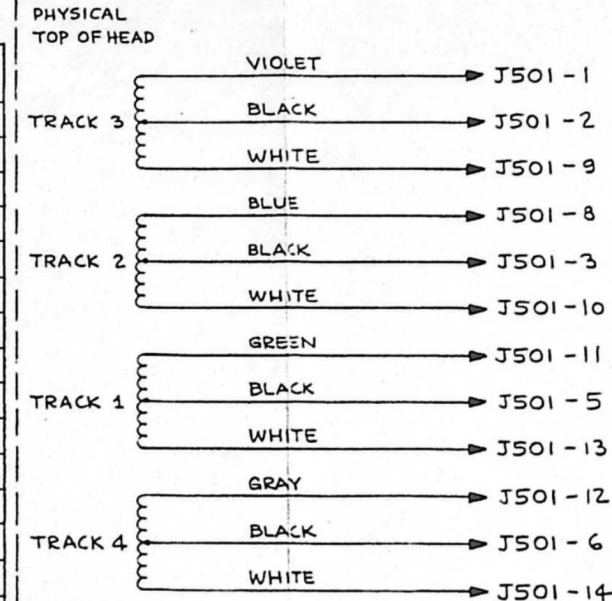
WRITE SCHEMATIC & WIRE LIST



WRITE CONNECTOR WIRE LIST-J502				
PIN	COLOR	DESCRIPTION	CUT LENGTH	
1	N.C.	N.C.		
2	O	3-C.T.		
3	N.C.	KEY		
4	O	2-C.T.		
5	O	1-C.T.		
6	O	4-C.T.		
7	9	4-φ1		
8	3	3-φ2		
9	9	3-φ1		
10	2	2-φ2		
11	9	2-φ1		
12	1	1-φ2		
13	9	1-φ1		
14	4	4-φ2		

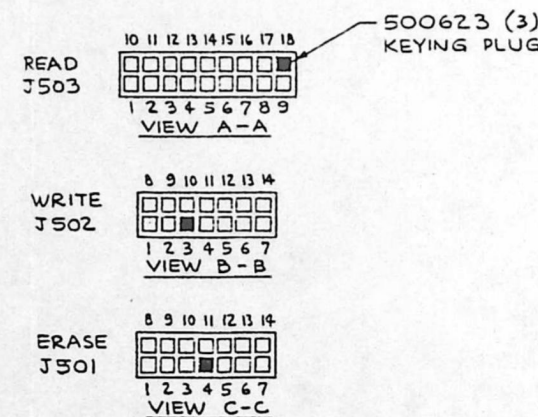
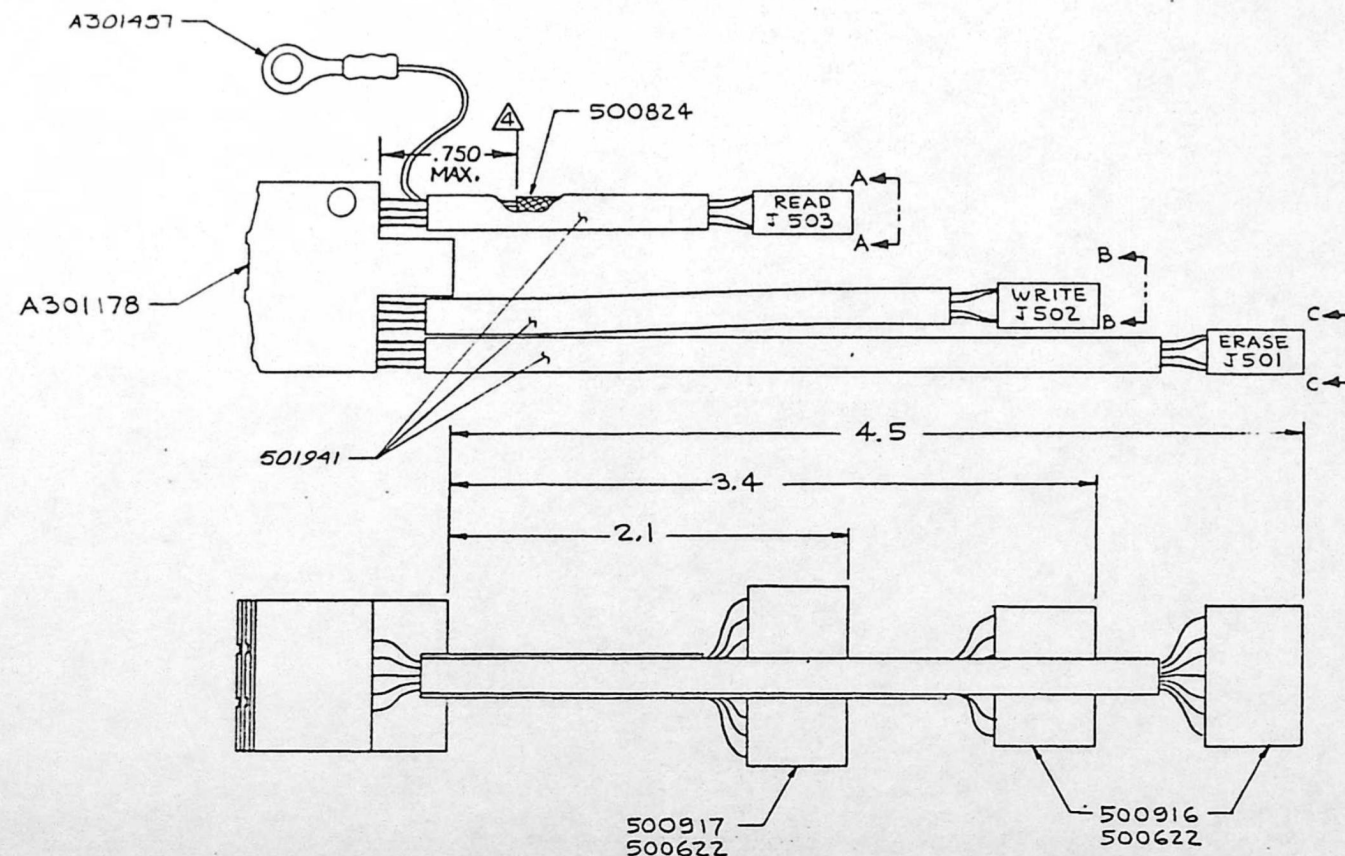
ALL LEADS OF EACH TRACK TWISTED IN TRIPLETS WITH MIN. OF 4 TWISTS PER INCH.

ERASE SCHEMATIC & WIRE LIST



ERASE CONNECTOR WIRE LIST-J501				
PIN	COLOR	DESCRIPTION	CUT LENGTH	
1	7	3-φ2		
2	O	3-C.T.		
3	O	2-C.T.		
4	N.C.	KEY		
5	O	1-C.T.		
6	O	4-C.T.		
7	N.C.	N.C.		
8	6	2-φ2		
9	9	3-φ1		
10	9	2-φ1		
11	5	1-φ2		
12	8	4-φ2		
13	9	1-φ1		
14	9	4-φ1		

ALL LEADS OF EACH TRACK TWISTED IN TRIPLETS WITH MIN. OF 4 TWISTS PER INCH.

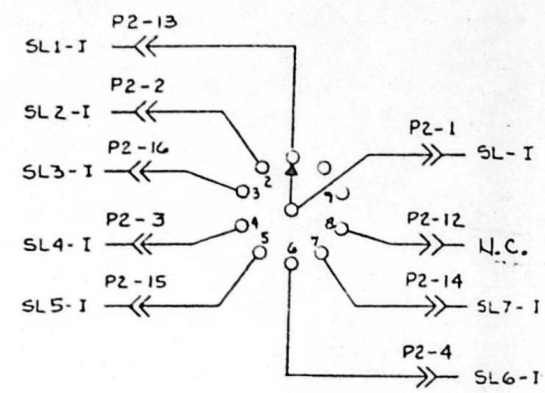


NOTES:

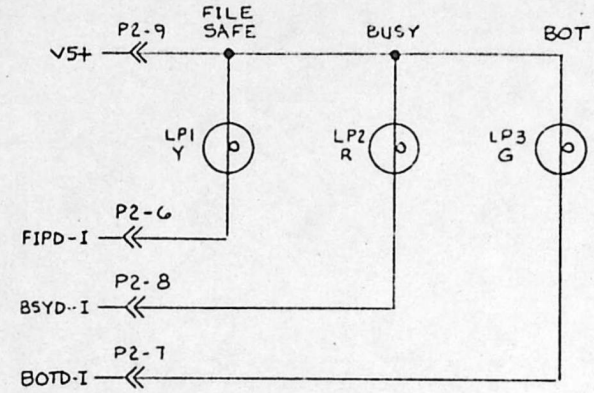
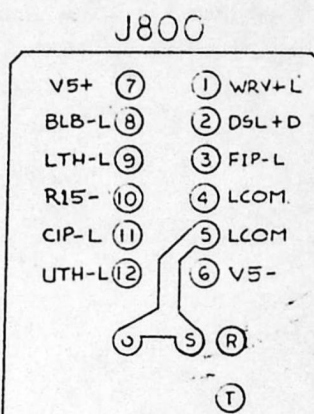
1. TRACK REFERENCES ARE PER ANSI STANDARD.
2. DO NOT REMOVE PROTECTIVE COVER ON HEAD FACE.
3. HEAD & LEADS ARE TO BE CAREFULLY HANDLED & ASSEMBLED.
4. THE SHIELDING AT HEAD END OF CABLE SHOULD NOT BE ANY FURTHER AWAY THAN .750 MAX.
5. ASSEMBLY PROCEDURE A310013

MATERIAL OR PROCESS:				FINISH OR PROCESS: *REDUCTION AVAILABLE			
301091-1				SCALE: 2/1			
301091				DATE: 2 FEB 1977			
301081				DRAWN: CLK			
301058-1				CHECKED:			
D301058				ENGINEER			
NEXT ASSEMBLY				PROJ. APPV:			
QTY PER KIT				DO NOT SCALE DRAWING			
UNIT							

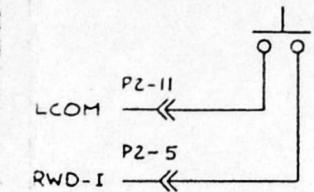
DEI DATA ELECTRONICS, INC. D301060
HEAD ASSEMBLY
4TS - DUAL GAP
HIGH DENSITY
SHEET 1 OF 1



UNIT SELECT-OPTION



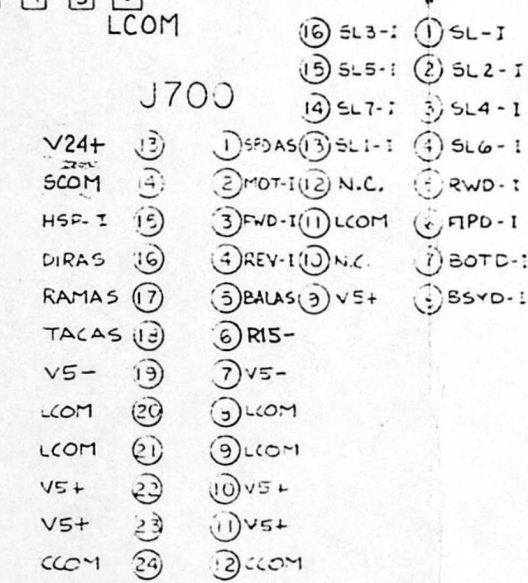
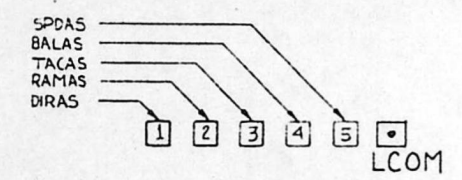
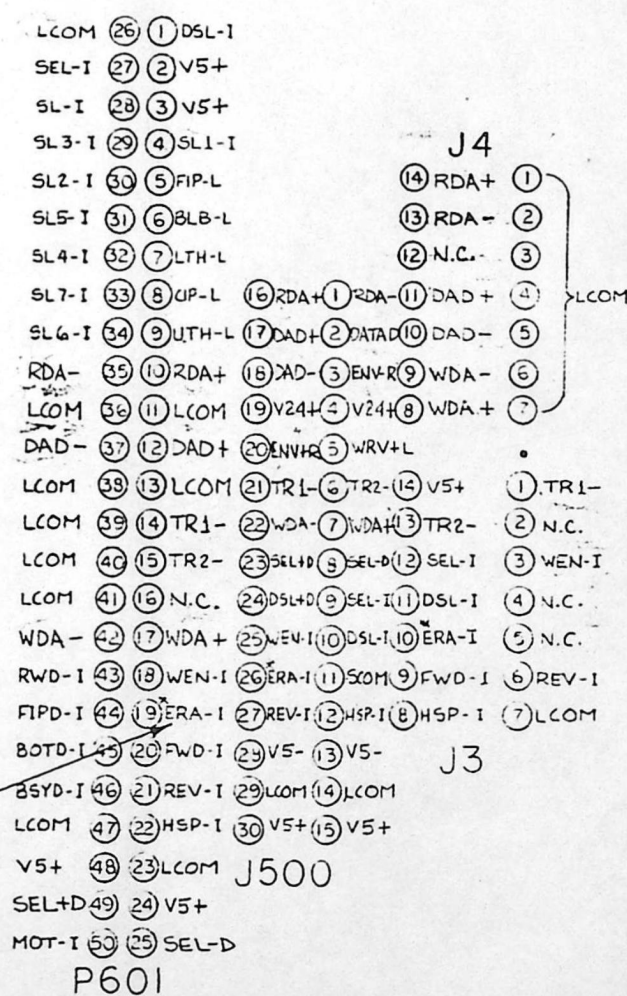
FRONT PANEL INDICATORS-OPTION



REWIND SWITCH-OPTION

D301196

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPD
A	ECO # 526	5-22-77	13	
B	ECO # 548	7-17-77	14	



DEI 301195

WITH A SEPARATE ERASE FUNCTION.
ERA-I SIGNAL USED ONLY ON DRIVES
2. REFERENCE ASSEMBLY NO. D301072.

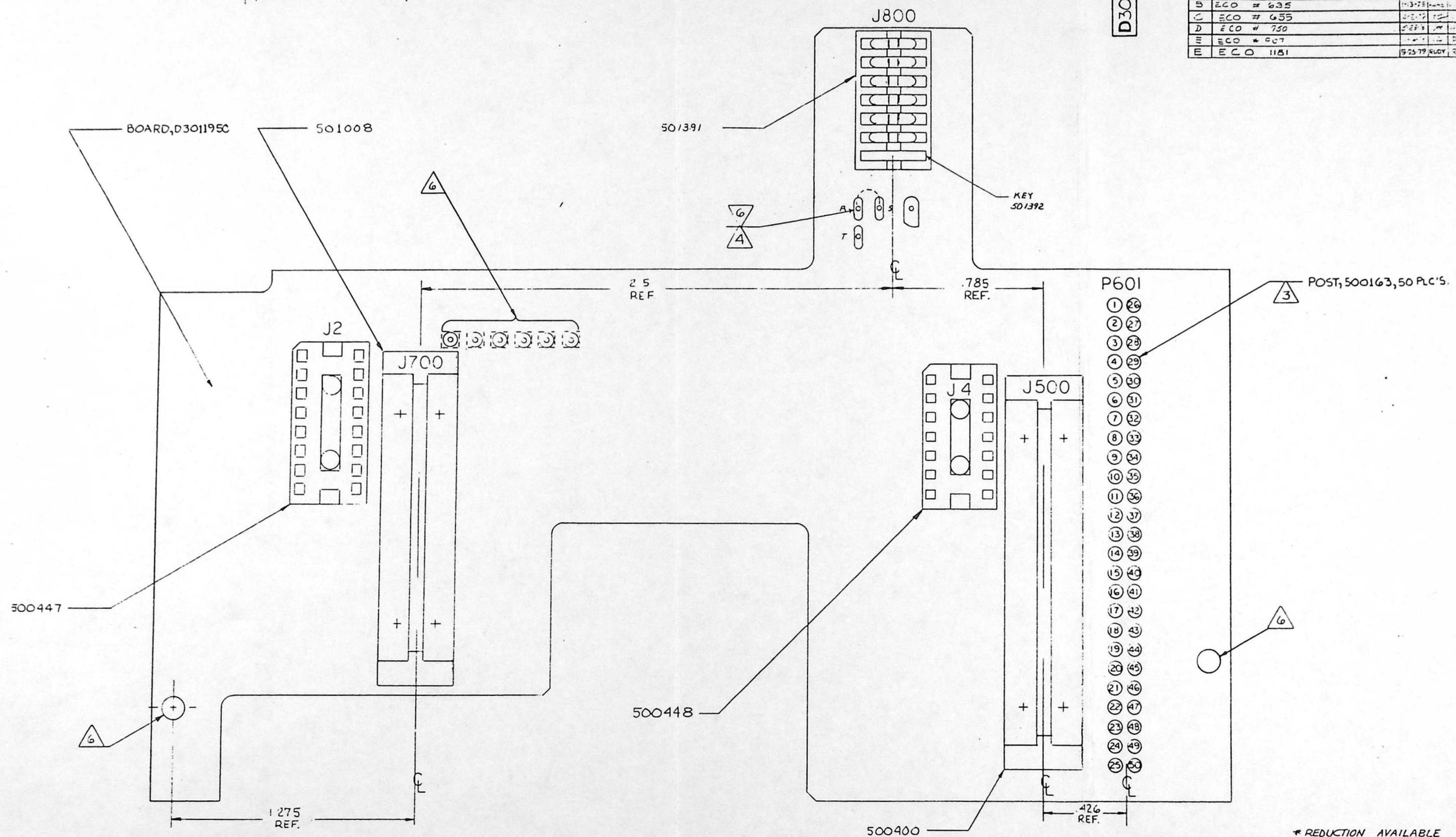
NOTES: 1. SOLDER SIDE SHOWN

MATERIAL OR DESCRIPTION		FINISH OR PROCESS	
UNLESS OTHERWISE SPECIFIED: 1. LINEAR DIMENSIONS: MILLIMETERS 2. ANGLES: DEGREES 3. DIMENSIONS: DECIMAL INCHES 4. DIMENSIONS: FRACTIONS OF AN INCH 5. DIMENSIONS: FRACTIONS OF AN INCH 6. DIMENSIONS: FRACTIONS OF AN INCH 7. DIMENSIONS: FRACTIONS OF AN INCH 8. DIMENSIONS: FRACTIONS OF AN INCH 9. DIMENSIONS: FRACTIONS OF AN INCH 10. DIMENSIONS: FRACTIONS OF AN INCH 11. DIMENSIONS: FRACTIONS OF AN INCH 12. DIMENSIONS: FRACTIONS OF AN INCH 13. DIMENSIONS: FRACTIONS OF AN INCH 14. DIMENSIONS: FRACTIONS OF AN INCH 15. DIMENSIONS: FRACTIONS OF AN INCH 16. DIMENSIONS: FRACTIONS OF AN INCH 17. DIMENSIONS: FRACTIONS OF AN INCH 18. DIMENSIONS: FRACTIONS OF AN INCH 19. DIMENSIONS: FRACTIONS OF AN INCH 20. DIMENSIONS: FRACTIONS OF AN INCH 21. DIMENSIONS: FRACTIONS OF AN INCH 22. DIMENSIONS: FRACTIONS OF AN INCH 23. DIMENSIONS: FRACTIONS OF AN INCH 24. DIMENSIONS: FRACTIONS OF AN INCH 25. DIMENSIONS: FRACTIONS OF AN INCH 26. DIMENSIONS: FRACTIONS OF AN INCH 27. DIMENSIONS: FRACTIONS OF AN INCH 28. DIMENSIONS: FRACTIONS OF AN INCH 29. DIMENSIONS: FRACTIONS OF AN INCH 30. DIMENSIONS: FRACTIONS OF AN INCH 31. DIMENSIONS: FRACTIONS OF AN INCH 32. DIMENSIONS: FRACTIONS OF AN INCH 33. DIMENSIONS: FRACTIONS OF AN INCH 34. DIMENSIONS: FRACTIONS OF AN INCH 35. DIMENSIONS: FRACTIONS OF AN INCH 36. DIMENSIONS: FRACTIONS OF AN INCH 37. DIMENSIONS: FRACTIONS OF AN INCH 38. DIMENSIONS: FRACTIONS OF AN INCH 39. DIMENSIONS: FRACTIONS OF AN INCH 40. DIMENSIONS: FRACTIONS OF AN INCH 41. DIMENSIONS: FRACTIONS OF AN INCH 42. DIMENSIONS: FRACTIONS OF AN INCH 43. DIMENSIONS: FRACTIONS OF AN INCH 44. DIMENSIONS: FRACTIONS OF AN INCH 45. DIMENSIONS: FRACTIONS OF AN INCH 46. DIMENSIONS: FRACTIONS OF AN INCH 47. DIMENSIONS: FRACTIONS OF AN INCH 48. DIMENSIONS: FRACTIONS OF AN INCH 49. DIMENSIONS: FRACTIONS OF AN INCH 50. DIMENSIONS: FRACTIONS OF AN INCH 51. DIMENSIONS: FRACTIONS OF AN INCH 52. DIMENSIONS: FRACTIONS OF AN INCH 53. DIMENSIONS: FRACTIONS OF AN INCH 54. DIMENSIONS: FRACTIONS OF AN INCH 55. DIMENSIONS: FRACTIONS OF AN INCH 56. DIMENSIONS: FRACTIONS OF AN INCH 57. DIMENSIONS: FRACTIONS OF AN INCH 58. DIMENSIONS: FRACTIONS OF AN INCH 59. DIMENSIONS: FRACTIONS OF AN INCH 60. DIMENSIONS: FRACTIONS OF AN INCH 61. DIMENSIONS: FRACTIONS OF AN INCH 62. DIMENSIONS: FRACTIONS OF AN INCH 63. DIMENSIONS: FRACTIONS OF AN INCH 64. DIMENSIONS: FRACTIONS OF AN INCH 65. DIMENSIONS: FRACTIONS OF AN INCH 66. DIMENSIONS: FRACTIONS OF AN INCH 67. DIMENSIONS: FRACTIONS OF AN INCH 68. DIMENSIONS: FRACTIONS OF AN INCH 69. DIMENSIONS: FRACTIONS OF AN INCH 70. DIMENSIONS: FRACTIONS OF AN INCH 71. DIMENSIONS: FRACTIONS OF AN INCH 72. DIMENSIONS: FRACTIONS OF AN INCH 73. DIMENSIONS: FRACTIONS OF AN INCH 74. DIMENSIONS: FRACTIONS OF AN INCH 75. DIMENSIONS: FRACTIONS OF AN INCH 76. DIMENSIONS: FRACTIONS OF AN INCH 77. DIMENSIONS: FRACTIONS OF AN INCH 78. DIMENSIONS: FRACTIONS OF AN INCH 79. DIMENSIONS: FRACTIONS OF AN INCH 80. DIMENSIONS: FRACTIONS OF AN INCH 81. DIMENSIONS: FRACTIONS OF AN INCH 82. DIMENSIONS: FRACTIONS OF AN INCH 83. DIMENSIONS: FRACTIONS OF AN INCH 84. DIMENSIONS: FRACTIONS OF AN INCH 85. DIMENSIONS: FRACTIONS OF AN INCH 86. DIMENSIONS: FRACTIONS OF AN INCH 87. DIMENSIONS: FRACTIONS OF AN INCH 88. DIMENSIONS: FRACTIONS OF AN INCH 89. DIMENSIONS: FRACTIONS OF AN INCH 90. DIMENSIONS: FRACTIONS OF AN INCH 91. DIMENSIONS: FRACTIONS OF AN INCH 92. DIMENSIONS: FRACTIONS OF AN INCH 93. DIMENSIONS: FRACTIONS OF AN INCH 94. DIMENSIONS: FRACTIONS OF AN INCH 95. DIMENSIONS: FRACTIONS OF AN INCH 96. DIMENSIONS: FRACTIONS OF AN INCH 97. DIMENSIONS: FRACTIONS OF AN INCH 98. DIMENSIONS: FRACTIONS OF AN INCH 99. DIMENSIONS: FRACTIONS OF AN INCH 100. DIMENSIONS: FRACTIONS OF AN INCH		SCALE: 1:1 DATE: 1-28-77 DRAWN: [Signature] CHECKED: [Signature] ENGINEER: [Signature] PROJ. APPV: [Signature] DO NOT SCALE DRAWING	
NEXT ASSEMBLY		FINISH OR PROCESS	

 DATA ELECTRONICS, INC.		D 301196
INTERCONNECT G		
SIGNAL DRAWING HIGH DENSITY SERIAL WITH CONTROL BOARD		CONT. NO. 1 REV. 1 SHEET 1 OF 1
THE INFORMATION, DATA AND THE DESIGN DISCLOSED HEREIN ARE THE PROPERTY OF DATA ELECTRONICS, INC. INFORMATION IS UNCLASSIFIED OR CONTAINS NO MATERIAL SUBJECT TO RESTRICTIONS AND WILL BE USED FOR THE DESIGN OF THE PRODUCT AND WILL BE SUBJECT TO THE PATENT, COPYRIGHT AND TRADE SECRET RIGHTS OF DATA ELECTRONICS, INC.		

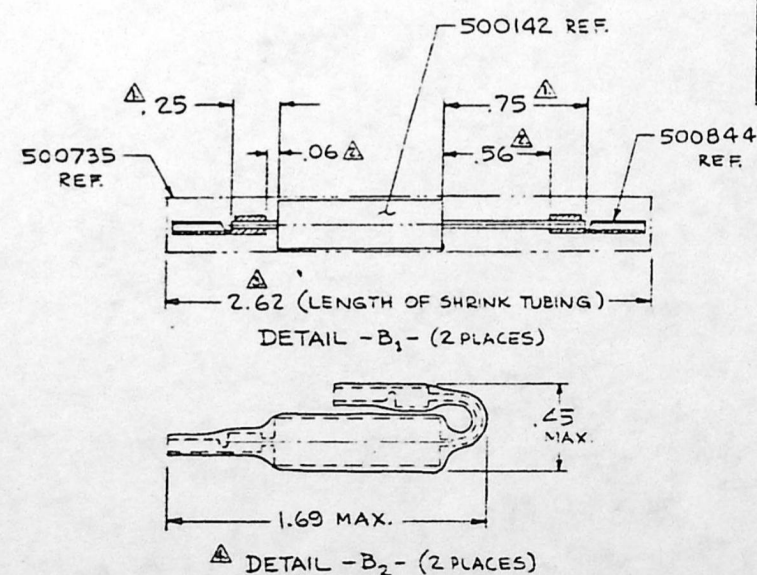
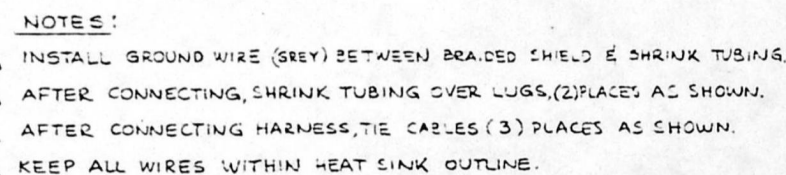
REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APPD
A	E.C.O. # 575	8-1-77	E	
B	E.C.O. # 635	10-3-78	E	
C	E.C.O. # 655	11-1-78	E	
D	E.C.O. # 750	5-23-79	E	
E	E.C.O. # 907	1-1-80	E	
E	E.C.O. 1181	9-25-79	KUDY	E.C.

D301072



- NOTES:
1. COMPONENT SIDE SHOWN.
 2. ASSEMBLY NUMBER AND CHANGE LEVEL TO BE STAMPED ON SOLDER SIDE.
 3. INSTALL POSTS WITH LONG END ON COMPONENT SIDE, 50 PLC'S.
 4. INSTALL JUMPER R-S, ON SOLDER SIDE.
 5. REF SIGNAL DRAWINGS D301196.
 6. MASK HOLES AS REQUIRED PRIOR TO SOLDER.

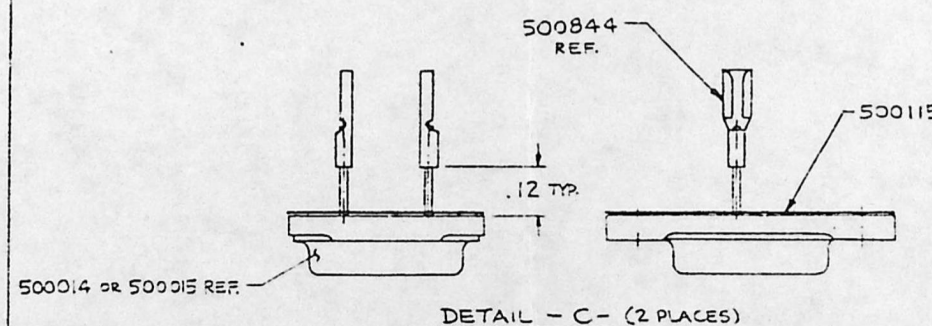
MATERIAL OR DESCRIPTION		SEE NOTES		FINISH OR PROCESS		SEE NOTES			
		UNLESS OTHERWISE SPECIFIED: 1. DIMENSIONS ARE IN INCHES 2. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 3. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 4. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 5. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 6. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 7. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 8. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 9. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 10. DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED		SCALE: 4/1 DATE: 7-1-77 NAME: T. FRESH CHECKED: ENGINEER: PROJ. APPV: 11/1 DO NOT SCALE DRAWING		DATA ELECTRONICS, INC. INTERCONNECT G HIGH DENSITY SERIAL WITH INTERCONNECT		D301072 CODE IDENT. NUMBER SHEET 1 OF 1	



NOTES:

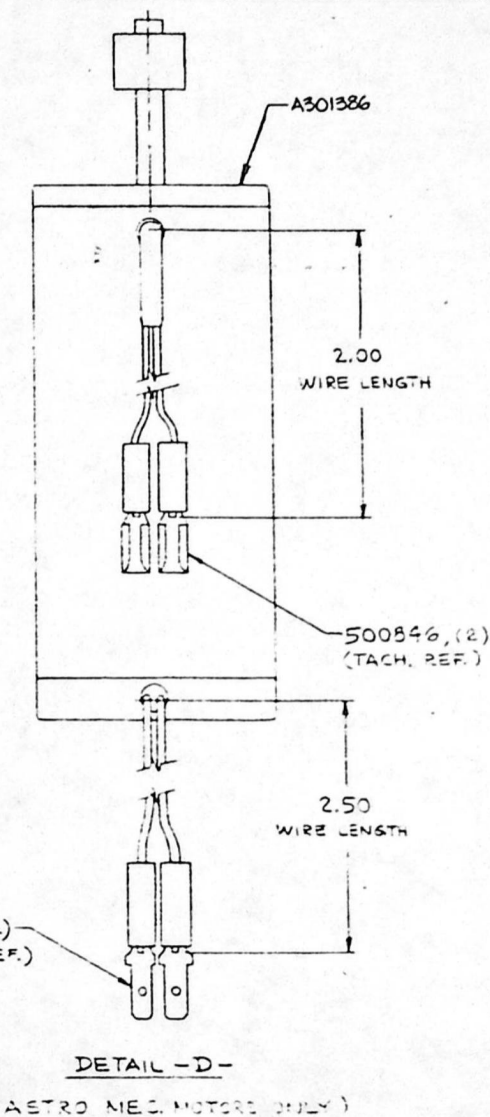
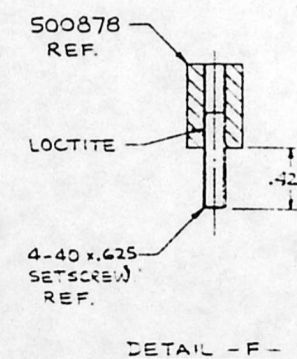
1. CUT LEAD ON BOTH ENDS OF CHOKE 500442 AS SHOWN;
2. INSTALL TERMINALS 500844 AS SHOWN; USE CRIMPING TOOL;
3. CUT SHRINK TUBING 500735 TO LENGTH SHOWN; INSERT HARDWARE;
4. START SHRINK PROCESS AT SHORT END; BEND LONG END AS SHOWN, WHILE TUBING STILL WARM;

WIRE LIST HEAT SINK ASSEMBLY			
FROM	SIZE (COLOR)	TO	SIGNAL NAME
J701-1	—	—	N.C.
J701-2	22 (0)	TACH.	TACH V
J701-3	22 (9)	TACH.	A COM.
J701-4	—	—	N.C.
J701-5	—	—	N.C.
J701-6	—	—	N.C.
J701-7	—	—	N.C.
J701-8	KEYING PLUG		N.C.
J701-9	22 (1)	Q1-2	V+
J701-10	22 (7)	Q2-1	BASE G2
J701-11	22 (8)	SHIELD	CCOM.
J701-12	22 (2)	Q1-1	BASE Q1
J701-13	22 (3)	Q2-2	V-
J701-14	22 (4)	Q2-3	MOTOR V
J701-15	22 (5)	L2-1	S COM.
MOTOR (RED)	(RED)	L2-2	
MOTOR (BLUE)	(BLUE)	L1-2	
Q1-3	22 (6)	L1-1	
Q1-3	22 (6)	Q2-3	



NOTES:

1. PRIOR TO INSTALLING TERMINALS, ADD INSULATOR SCREWS ON TRANSISTOR CASE. SEE NOTE Δ SHEET 1.
2. INSTALL TERMINALS 500B44 AS SHOWN. USE CRIMPING TOOL. MUST ALSO BE SOLDERED.

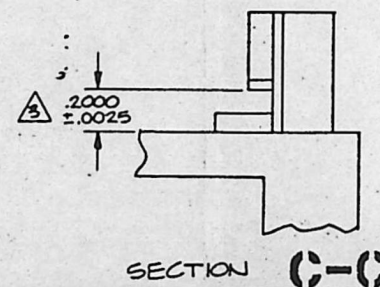
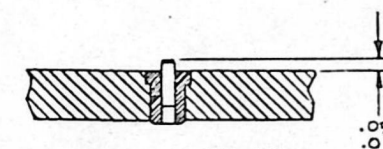
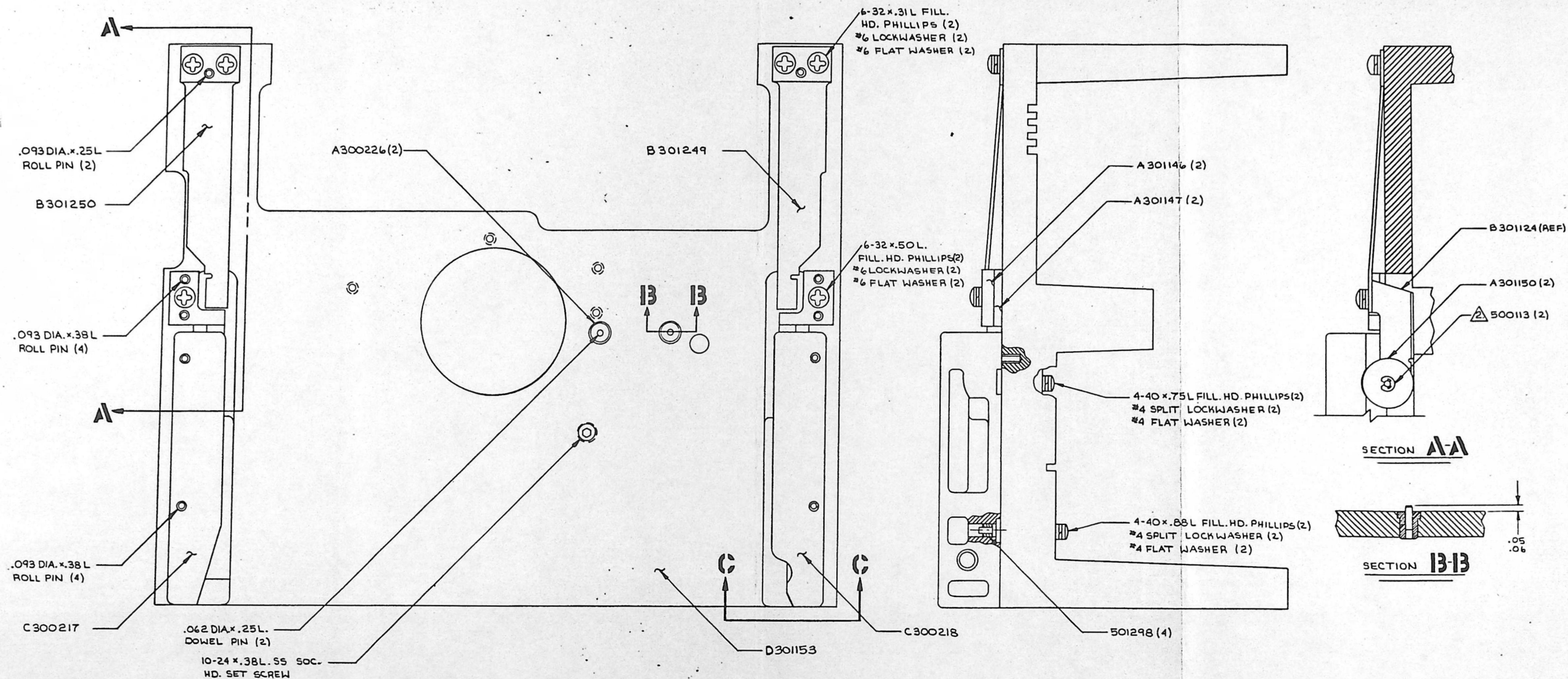


NOTE: INSTALL TERMINALS 500340 & 500345
 AS SHOWN IN THE CRIMPING TOOL.

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	CHK
A	E.C.O. #554	11/13/79	MS	✓
B	E.C.O. #557	11/13/79	MS	✓
C	E.C.O. #555	11/13/79	MS	✓
D	E.C.O. #635	11/13/79	MS	✓
E	E.C.O. #615	11/13/79	MS	✓
F	E.C.O. #775	11/13/79	MS	✓
G	E.C.O. #999	11/13/79	MS	✓
H	E.C.O. #1058	11/13/79	MS	✓
J	E.C.O. #1049	11/13/79	MS	✓
K	E.C.O. #1120	11/13/79	MS	✓
K	E.C.O. 1274	11/13/79	MS	✓
K	E.C.O. #1302	11/13/79	MS	✓
K4	E.C.O. #1364	11/13/79	MS	✓
K5	E.C.O. #1818	11/13/79	MS	✓
K6	E.C.O. #1861	11/13/79	MS	✓

MATERIAL OR DESCRIPTION:		FINISH OR PROCESS:	
1. INSTRUCTIONS: THESE SPECIFIED MATERIALS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE MATERIALS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE MATERIALS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. 2. MATERIALS: THESE MATERIALS SHALL BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE MATERIALS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE MATERIALS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. 3. FINISH: THESE FINISHES SHALL BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE FINISHES ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE FINISHES ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. 4. PROCESS: THESE PROCESSES SHALL BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE PROCESSES ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE PROCESSES ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. 5. DIMENSIONS: THESE DIMENSIONS SHALL BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE DIMENSIONS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE DIMENSIONS ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. 6. TOLERANCES: THESE TOLERANCES SHALL BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE TOLERANCES ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING. THE TOLERANCES ARE TO BE USED IN THE MANUFACTURE OF THE PARTS LISTED IN THE ATTACHED DRAWING.		SCALE: 1/2" DATE: 5 JAN 1977 DRAWN: [Signature] CHECKED: [Signature] IN-CHARGE: [Signature] ENG. APPROV: [Signature]	
		FINISH OR PROCESS: REDUCTION AVAILABLE	
		DEI DATA ELECTRONICS, INC. TEST SINK ANALYZER QTY: 100 POW. SUPPLY TEMP. 25°C	
		THE INFORMATION CONTAINED HEREIN IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE	

REVISIONS				
LETTER	DESCRIPTION OF CHANGE	DATE	BY	APP
A	ECO 830	7-17-75	JS	
A	REDRAWN	10/6/79	WV	
A	ECO & 1255A	11/29/73	CS	!!
A+	ECO 1779	12-5-80	JS	2



3. THIS DIMENSION MUST BE MAINTAINED IN AREA INDICATED.

MATERIAL OR DESCRIPTION:		UNLESS OTHERWISE SPECIFIED, 1. LINEAR DIMENSIONS IN INCHES 2. BREAK SHARP EDGES, 90 DEG. 3. MACHINED SURFACE FINISHNESS 8 MICRONS INCHES R.M.S. 4. DIMENSIONS APPLY BEFORE PLATING 5. MACHINED SURFACES SHALL BE 1/8 IN. IN ALL PLACES, 90 DEGREE DIAMETERS IF WITHIN 90S T.E.M. 6. ANGULAR TOLERANCES: 3° P, 90° ± 3° 7. LINE AND TOLERANCES: ± .005 8. 1:1.02, 1:1.04, 1:1.05, 1:1.06, 1:1.08, 1:1.10 9. RESISTANCE VALUES IN OHMS 10. CAPACITANCE VALUES IN MICROFARADS		FINISH OR PROCESS: DATE: 10/16/79 DRAWN: J. VALLANT CHECKED: J. VALLANT ENGINEER:		DATA ELECTRONICS, INC. MECHANICAL ASSEMBLY S2 TYPE CODE INCHENT. NUMBER SHEET 1 OF 1	
D3010558-1		D301010-1		D301010-1		D301010-1	
NEXT ASSEMBLY		DIT PER		QTY PER		DIT PER	

0	062677	020126	176221	116400	055400	031400	172414	000003	e? V....[.3.u..
10	054126	004227	000320	004201	000011	000011	111005	000011	XV...P.....
20	004201	000027	000011	145000	153120	133120	143001	141000	J.VP6PF.B
30	040177	024125	004217	020127	004134	004130	000034	014177	@.(U.. W.\.X...
40	000034	020124	024175	004145	000056	024124	123000	030126	.. T(..e..(T&.0
50	112423	000060	132433	145000	124400	000043	004130	000057	...05.J.)..#.X.
60	034122	020123	030126	112400	021400	041000	151400	175400	8R S0V..#.B.S..
70	014123	000064	030124	102400	034126	145000	166400	001755	.S.40T..8VJ.m..
100	115000	021000	041400	151400	175400	125404	000773	020005	..".C.S....+...
110	101005	000405	020403	040020	002003	000022	020403	061122	!.@.....!.b
120	002002	000010	000100	000023	000377	005015	004000	000030	@.....
130	024200	147415	000245	001401	061022	152000	073122	063622	(.0..%.b.T.vRg
140	000137	070422	151112	001400	001401	024174	030175	073022	.._q.RJ....(.0.v
150	062022	152400	071122	063622	000153	070422	151113	001401	d.U.rRg..k .RK.
160	151300	151213	125405	151301	152001	001400	073022	030176	RQR.+ .RAT...v.0
170	071122	063622	000171	000146	177766	177401	000040	000000	rRg..y.f.v... .
200	000400	063610	000201	064610	044244	020240	123440	024241	..g...i.H\$ ' (
210	122415	000220	175400	024242	106432	175400	000220	125021	%.....(".....*
220	024244	063511	000221	065111	125362	000221	001400	054243	(\$gI...jI*r....X
230	010243	031400	025000	125005	002243	004217	151400	000232	..#3.*.*..#.S..
240	000117	000015	000011	000000	000000	054126	050277	004227	.0.....XVP?.
250	000300	020277	004256	020126	004256	000255	054243	152621	..@ ?.. V...-X#U
260	142401	024275	125400	142533	000260	004217	151220	151220	E.(=+.E[.0..R.R
270	151224	000261	024276	004217	002243	000057	020040	000000	R..1(>...#./ .
300	005015	040506	040524	020114	051105	047522	026122	052040	..AFAT LREOR,RT
310	050101	020105	052123	052101	051525	036440	000040	000000	PA ETSTASU= . .
320	005015	051106	046517	020040	052115	035060	000000	047503	..RFMO TM:0..0
330	054520	044522	044107	024124	024503	043504	026103	034461	YPIRHG(T)CGD,C9
340	033467	046101	020114	044522	044107	051524	051040	051505	77LA LIRHGSTR S
350	051105	042526	000104	000000	000000	000000	000000	000000	REEV.D.....
360	000000	000000	000000	000000	000000	000000	000000	000000	.....

400	000000	000050	000000	000000	000440	177777	177777	000440	...(.
410	000000	177777	177777	000410	000424	000424	177777	000440	.....
420	000440	000000	003000	000000	000000	000000	000000	000000	. ....
430	000000	000000	000000	000000	000000	000000	000000	000000	.....

1370	000000	000000	000000	000000	000000	----	----	----	
------	--------	--------	--------	--------	--------	------	------	------	-------

0	000000	034047	034504	034152	034164	000000	000000	000000	..8'9D8j8t....
10	000000	000000	000400	000000	000000	000000	000000	032324	4
20	000000	000000	000000	000000	000000	000000	000000	000000	.....

40	000546	000000	000702	023031	000000	000000	000000	000000	.f...B&.....
50	000000	026672	024542	025153	025041	025216	025116	025366	..-:)b*k*!*.*N*
60	025367	026761	025246	012270	000065	000000	000000	024662	*w- *&.8.5....)
70	000000	000000	000000	000000	000000	000000	000000	000000	.....
100	000000	000000	000003	000000	000000	000004	000000	000007	.....
110	000004	000004	000000	000000	000400	000000	000755	001732	m.
120	001633	001233	002233	012233	012254	012250	000400	000000	,.(...
130	000000	000000	000000	000000	000000	000000	000000	000000	.....
140	001722	000142	000000	000000	000000	000000	000000	000000	.R.b.....
150	000000	000000	000000	000000	000000	000000	000000	000000	.....
160	000000	000000	000000	000000	000000	000002	000003	000004	.....
170	000005	000006	000007	000010	000011	000012	000013	000015	.....
200	000020	000040	000053	000055	000060	000077	000120	000136	...+.-.0.?P.
210	000377	000400	012270	012436	014211	014557	015432	015437	8.....0...
220	015445	015471	015635	016127	016205	016225	016264	016277	..%.9...W.....4.
230	016407	016442	016656	016734	016743	016747	016761	016771	\..c.g.q.
240	017014	017035	017057	017113	017114	017123	017135	017136	/..K.L.S.J.
250	017326	017347	021071	021120	021121	021141	021142	021154	..V.g"9"P"Q"a"b"
260	021211	021234	021250	021270	021304	021323	021337	021353	..".("8"D"S"
270	021407	021451	021503	021572	021644	021645	021720	021745	#.#)C#.#\$%#F#
300	021756	021773	022022	022301	022343	022350	023062	023064	#n#.\$.\$A\$c\$h&2&
310	023071	000006	000176	044536	001000	031346	031402	031421	&9....I^..2f3.3
320	000000	000000	000000	000000	000000	000000	000000	000000	.....

370	000000	000000	000000	000000	000000	000000	000000	002002	.....
400	000000	000321	000000	000000	035220	000754	177777	035220	...Q.....:..1..:
410	000000	177777	177777	000410	000424	000424	177777	000440	.....
420	000440	000000	003074	000000	000000	000000	000000	000000	...<.....
430	000000	000000	000000	000000	000000	000000	000000	000000	.....
440	041517	050131	051111	043510	052040	024103	024440	042101	COPYRIGHT (C) D
450	052101	020107	042516	042522	040514	020103	047522	050117	TA GENERAL CORP
460	051101	052111	047516	020061	034467	032454	020061	034467	RATION 1975, 19
470	033454	020061	034467	034054	030471	033471	020040	020101	7, 1978, 1979
500	046114	020122	044507	044124	051440	051105	051505	051126	LL RIGHTS RESER
510	042504	000000	046111	041505	047123	042504	020115	040524	ED..LICENSED MA
520	042522	044501	046055	050122	047520	042522	052131	020117	ERIAL-PROPERTY
530	043040	042101	052101	020107	042516	042522	040514	020103	F DATA GENERAL
540	047522	050117	051101	052111	047516	000000	000000	000000	ORPORATION.....
550	000000	000000	000000	000000	000000	000000	000000	000000	.....

710	000000	000000	041517	050131	051111	043510	052050	041451	COPYRIGHT(C
720	042107	041454	030471	033465	026061	034467	033454	030471	DGC, 1975, 1977, 19
730	033470	026061	034467	034501	046114	020122	044507	044124	78, 1979 ALL RIGH
740	051440	051105	051505	051126	042504	000000	022124	052117	S RESERVED..\$TT
750	000000	022124	052111	000000	004457	000000	000000	000000	..\$TTI.../.....
760	000000	000000	000000	000000	000000	000000	000000	000000	.....

1030	000000	000000	000000	020413	040016	020410	041777	006017	!.@!.C..
1040	021022	006307	034012	020404	041411	006212	000546	023162	"..G8!.C....f&
1050	000000	000000	000000	000000	000000	000000	000000	000000	.....

12230	000000	000000	000000	024662	000000	000000	000000	000000	)2.....
12240	000000	000000	000000	000000	000000	000000	000000	000000	.....
12250	012233	000000	000000	000000	000000	000000	000000	000000	.....
12260	000000	000000	000000	000000	000000	000000	000000	000000	.....
12270	006262	020212	040063	020140	006274	000001	006306	006301	.2.@3`<...F.
12300	025300	000077	006223	006301	025374	000164	000077	006257	*@.?...A*..t.?.
12310	025414	000423	111220	025000	044415	025001	044414	024	*.I*.I.(
12320	125005	000403	024403	044406	000414	046520	000000	042	CORPORATIOND
12330	000000	000000	000000	000000	006301	025432	000077	000750	A+...?..

12350	044132	020566	030125	024153	045002	126520	045003	006225	HZ!v0U(kJ.-PJ..
12360	006303	006246	000152	002233	000401	101011	000417	030124	.C.&.j.....0
12370	031000	112415	000404	020442	142414	006303	030153	024173	2.....!E..C0k(
12400	132400	050153	020535	133033	000755	010153	126400	044132	5.Pk!]6..m.k-.H
12410	024153	030211	006253	030156	133000	021000	040156	030157	(k0..+0n6..@n0
12420	133000	021000	040157	006301	025474	000153	000153	000077	6..@o.A+<.k.k.
12430	020153	024311	122400	040147	000407	000222	006262	020140	k(I%.@g.....2
12440	006274	000001	006306	020213	040063	006226	102400	040115	.<...F .@3....@
12450	040112	040113	040100	040103	006243	006225	006303	006257	@J@K@C@C.#...C.
12460	025534	000450	006260	013044	000445	111000	021000	101113	+\\.(0.\$.%... ..
12470	000403	006231	000751	101213	000404	006301	025674	000077	i.....A+<.
12500	007001	010100	000417	006247	000101	001233	000401	006303	...@...'.A.....
12510	102400	006240	001233	000400	006247	012535	001233	000401	'.]...
12520	006303	010103	000721	006247	000104	001633	000401	006303	.C.C.Q.'.D.....
12530	000713	006301	025550	000077	000723	000000	000006	000241	.K.A+h.?S.....
12540	006415	042111	051513	020111	047111	052111	040514	044532	..DISK INITIALI
12550	042522	020055	020122	042526	020060	033056	033060	000000	ER - REV 06.60.
12560	006415	042111	051513	020104	051111	053105	020115	047504	..DISK DRIVE MO
12570	042514	020116	052515	041105	051077	020000	006536	052040	EL NUMBER? ..T
12600	042122	044526	042440	052131	050105	006400	006504	044523	DRIVE TYPE...DI
12610	045440	052516	044524	037440	000000	006511	046114	042507	K UNIT? ...ILLE
12620	040514	020104	044523	045440	052516	044524	020104	042503	AL DISK UNIT DE
12630	046101	051101	052111	047516	020415	000000	006504	044523	LARATION!....DI
12640	045440	041517	047124	040511	047123	020136	042040	024136	K CONTAINS ^D (
12650	047451	020102	046117	041513	051415	000000	006503	047515	O) BLOCKS....CO
12660	046501	047104	037440	000000	006525	047113	047117	053516	MAND? ...UNKNOW
12670	020103	047515	046501	047104	020055	020103	047515	046501	COMMAND - COMM
12700	047104	051440	040522	042415	043125	046114	026120	040522	NDS ARE.FULL,PA
12710	052111	040514	026124	042523	052054	046111	051524	026106	TIAL,TEST,LIST,
12720	051101	046505	026122	042515	040520	026105	047124	042522	RAME,REMAP,ENTE
12730	026104	044523	045454	051524	047520	006400	006503	047515	,DISK,STOP...CO
12740	046501	047104	020104	042523	052122	047531	051440	040516	MAND DESTROYS A
12750	054440	050122	042526	044517	052523	020122	042117	051440	Y PREVIOUS RDOS
12760	042111	051513	020123	052122	052503	052125	051105	006522	DISK STRUCTURE.
12770	042117	051440	044516	044524	027506	020115	052523	052040	DOS INIT/F MUST
13000	041105	020104	047516	042440	047516	020104	044523	045440	BE DONE ON DISK
13010	040506	052105	051040	041517	046515	040516	042015	052131	AFTER COMMAND.T
13020	050105	020103	047516	052122	047514	026501	020116	047527	PE CONTROL-A NO
13030	020124	047440	040502	047522	052040	053511	052110	047525	TO ABORT WITHO
13040	052040	046117	051523	006400	026172	013143	026200	013145	T LOSS....c,..
13050	026210	013147	026216	013151	026224	013153	026232	013155	,...g,...i,...k,..
13060	026240	013157	026254	013167	026246	013171	026262	013161	, .o,...w,&.y,2.
13070	026270	013163	026300	013165	177777	043125	046114	000000	,8.s,@.u..FULL.
13100	050101	051124	044501	046000	052105	051524	000000	046111	PARTIAL.TEST..L
13110	051524	000000	043122	040515	042400	051105	046501	050000	ST..FRAME.REMAP
13120	042516	052105	051000	042111	051513	000000	051524	047520	ENTER.DISK..STO
13130	000000	042105	041125	043400	047117	042105	041125	043400	..DEBUG.NODEBUG
13140	044516	044524	000000	000001	013623	100000	013220	100000	INIT.....
13150	013221	100000	015635	100001	015471	100001	014557	100000	9...o.
13160	014211	000000	015432	000000	015437	000000	015445	000000	%.
13170	013173	000000	013174	063077	006212	026404	000000	026410	f?..-...-
13200	000001	177777	054505	051400	047117	000000	006501	047123	YES.NO...AN
13210	053505	051040	054505	051440	047522	020116	047415	000000	WER YES OR NO..
13220	101021	101040	102560	040547	054320	006315	000005	006301	pAgXP.M...
13230	026766	000077	006224	006303	006233	006244	006246	000073	-v.?...C...\$.&.
13240	002233	006305	000774	006237	000772	006243	020115	024113	...E.....# M(
13250	107004	000460	006301	027030	000077	030121	021000	101014	...0.A...?0Q"...
13260	000403	006226	014103	030121	021000	024142	106033	000436	C0Q".(b...
13270	006301	027072	000077	024142	045000	024151	045007	102400	.A.:?(bJ.(iJ...
13300	041001	006241	001233	100400	041001	014100	030120	025000	B..!....B..@0P*
13310	141000	123000	040407	020211	122405	000410	040404	102400	B.&.A. .%.A...
13320	006240	000000	000000	102000	040103	006301	027146	000077	@C.A.f.
13330	002316	020441	101004	000722	006301	027202	000077	020	N!!...R.A...?
13340	101014	000425	020113	101014	000416	030120	021000	024	ATA CORPORATION
13350	122640	025003	106433	000407	006301	027236	000077	014103	% *.....A...?

13370	000077	000734	000000	006452	025052	020103	044105	041513	.?.\...*** CHECK
13400	044516	043440	043117	051040	041101	042040	041114	047503	ING FOR BAD BLOC
13410	045523	020052	025052	006400	006516	047440	047105	053440	KS ***...NO NEW
13420	042522	051117	051123	020104	042524	042503	052105	042040	ERRORS DETECTED
13430	047516	020104	044523	045415	000000	052520	042101	052111	ON DISK...UPDAT
13440	047107	020104	044523	045440	043117	051115	040524	020122	NG DISK FORMAT
13450	042526	020116	052515	041105	051040	052117	020103	052522	EV NUMBER TO CU
13460	051105	047124	006400	006520	040522	052111	040514	020111	RENT...PARTIAL
13470	047111	052040	051125	047040	041517	046520	046105	052105	NIT RUN COMPLET
13500	006400	006516	042527	020105	051122	047522	051440	043117	...NEW ERRORS F
13510	052516	042040	047516	020104	044523	045415	000000	052520	UND ON DISK...U
13520	042101	052111	047107	020102	040504	020102	046117	041513	DATING BAD BLOC
13530	020124	040502	046105	020124	047440	044516	041514	052504	TABLE TO INCLU
13540	042440	052110	042515	006400	047117	052040	042516	047525	E THEM..NOT ENO
13550	043510	020122	047517	046440	043117	051040	052520	042101	GH ROOM FOR UPD
13560	052105	020055	020123	052507	043505	051524	020106	052514	TE - SUGGEST FU
13570	046040	044516	044524	006400	041522	044524	044503	040514	L INIT..CRITICAL
13600	020104	044523	045440	041114	047503	045523	020102	040504	DISK BLOCKS BA
13610	020055	020123	052507	043505	051524	020106	052514	046040	- SUGGEST FULL
13620	044516	044524	006400	054320	006315	000005	000404	006301	INIT..XP.M.....
13630	030060	000077	006257	030014	000773	006273	044501	006263	00.?./0....;IA.
13640	125014	000766	024475	125015	000763	020475	122433	000760	*..v)=*..s!=%..
13650	006225	006303	020110	030120	041000	020467	040474	102400	...C HOPB.!7A<.
13660	040460	010471	022470	040460	010454	006301	030114	013740	A0.9%8A0.,.A0L.
13670	013743	000077	006240	002233	010000	006233	006244	152400	.c.?. .....\$U.
13700	006247	000073	002233	006305	000773	006237	000771	006233	.'. ;...E.....y.
13710	006244	152400	006246	000073	002233	006305	000773	030422	.\$U..&. ;...E..1.
13720	006242	006305	000401	006237	000765	014412	000733	006243	..E.....u....[.
13730	020113	101015	000421	006301	030150	000077	002316	000000	K.....A0h.?.N.
13740	000000	001000	000005	000000	013744	155555	133333	066667	d[m6[m
13750	155556	125252	000000	006301	030236	000077	020112	101015	[n**...A0..? J.
13760	000405	006301	030272	000077	002316	102000	030120	041002	...A0:?.N..0PB.
13770	006215	102400	006240	001233	000400	020141	006252	001233	 a.*.
14000	000010	006221	006301	030370	000077	002316	006516	052515	A0x.?.N.NU
14010	041105	051040	047506	020120	040524	052105	051116	051440	BER OF PATTERNS
14020	052117	020122	052516	020050	030455	032451	020077	020000	TO RUN (1-5) ?
14030	044514	046105	043501	046040	047125	046502	042522	020117	ILLEGAL NUMBER
14040	043040	050101	052124	042522	047123	006400	006452	025052	F PATTERNS...***
14050	020120	040524	052105	051116	020043	020136	042040	024136	PATTERN # ^D (
14060	047451	020052	025052	006400	006501	046114	020120	040524	O) ***...ALL PA
14070	052105	051116	051440	051125	047054	020124	047517	020115	TERNS RUN, TOO
14100	040516	054440	042111	051513	020105	051122	047522	051440	ANY DISK ERRORS
14110	052117	020103	047515	050114	042524	042441	006400	006452	TO COMPLETE!...*
14120	025052	020101	046114	020120	040524	052105	051116	051440	** ALL PATTERNS
14130	051125	047040	025052	025015	000000	006503	051111	052111	RUN ***...CRIT
14140	041501	046040	042111	051513	020102	046117	041513	051440	CAL DISK BLOCKS
14150	040522	042440	041101	042054	020122	042117	051440	041501	ARE BAD, RDOS CA
14160	047116	047524	020102	042440	041125	044514	052015	040502	NNOT BE BUILT.AE
14170	047522	052111	047107	006400	006506	052514	046040	042111	ORTING...FULL DI
14200	051513	020111	047111	052040	041517	046520	046105	052105	SK INIT COMPLETE
14210	006400	054320	006315	000005	030120	021003	101120	024110	..XP.M..0P"...P(E
14220	107000	044430	030120	021000	024425	122415	000452	006257	..I.0P").%.*.
14230	030706	000407	006227	000405	000416	006301	026414	000077	1F.....A-..?
14240	006257	030630	000773	006260	013175	000770	101014	000434	./1....0....x....
14250	000752	000000	020073	101014	000411	020074	024111	106433	.j.. ;.... <(I..
14260	000405	006301	031006	000077	000754	020073	024074	006230	...A2..?.1 ;(<..
14270	000420	006304	000401	006243	006301	030762	000077	000723	...D....#.A1r.?.S
14300	006301	031102	000077	020115	101014	014103	006232	002316	.A2B.? M...C...N
14310	006301	031200	000077	000725	006504	047440	054517	052440	.A2..?.U.DO YOU
14320	053511	051510	020124	047440	042105	041514	040522	042440	WISH TO DECLARE
14330	040516	054440	046517	051105	020102	046117	041513	051440	ANY MORE BLOCKS
14340	041101	042077	020000	006502	040504	020102	046117	041513	BAD? ..BAD BLOCK
14350	020116	052515	041105	051040	024124	054520	042440	051116	NUMBER (TYPE RE
14360	052125	051116	020124	047440	051524	047520	024440	037440	TO REFORMATION?
14370	000000	041101	042040	041114	047503	045440	042516	052105	..RAD BLOCK ENTR

14410	020116	047524	020122	052516	020127	044524	044040	052110	NOT RUN WITH TF
14420	044523	020102	046117	041513	020102	040504	006502	046117	IS BLOCK BAD. BLOC
14430	041513	020116	047524	020101	041503	042520	052105	042015	CK NOT ACCEPTED
14440	000000	006502	040504	020102	046117	041513	020114	044523	...BAD BLOCK LI
14450	052040	044523	020106	052514	046015	052516	040502	046105	T IS FULL. UNABLE
14460	020124	047440	042516	052105	051040	040516	054440	046517	TO ENTER ANY M
14470	051105	020102	040504	020102	046117	041513	051415	000000	RE BAD BLOCKS...
14500	006502	046117	041513	020111	051440	050101	051124	020117	.BLOCK IS PART
14510	043040	041101	042040	041114	047503	045440	051105	046501	F BAD BLOCK REM
14520	050040	040522	042501	006511	052040	041501	047040	047516	P AREA. IT CAN O
14530	046131	020102	042440	042105	041514	040522	042504	020102	LY BE DECLARED
14540	040504	020125	051511	047107	020106	052514	046040	044516	AD USING FULL I
14550	044524	020117	051040	051105	046501	050015	000000	054320	IT OR REMAP...X
14560	006315	000005	020312	030120	041003	025001	035002	102400	.M... J0PB.*:...
14570	041001	041002	125015	175014	000410	006301	032006	000077	B.B.*.....A4...
14600	002316	006301	026414	000077	006257	032106	000773	006260	.N.A-..?./4F....
14610	013175	000770	101015	006214	030120	021000	024110	122640	...x....0P".(H%
14620	024162	106433	105000	045003	040556	006301	032234	001636	(r....J.An.A4...
14630	015002	000077	006257	032364	000416	006273	044542	006263	...?./4t...;Ib.
14640	125014	000501	020536	024537	122433	000475	024312	106433	*..A!^).%..=(J..
14650	000472	041003	006257	032606	000441	006227	000774	020073	..B../5..!.....
14660	024074	041001	045002	025003	044076	125014	014076	000401	(<B.J.*.H>*..>..
14670	006237	101011	000413	025001	125014	000405	021002	024111	*.*.....(
14700	106432	000404	004450	000406	000433	006301	032702	000077	(.....A5B.
14710	000742	006301	032752	000077	000736	034462	030120	021400	.b.A5j.?.^920P#.
14720	041001	021401	025003	122423	015001	000401	041002	025001	B.#.*.%.....B.*.
14730	125014	000404	024111	106432	000412	004415	000760	102000	*...(I.....p.
14740	040103	002316	006301	032554	000077	000665	006301	032442	@C.N.A51.?5.A5
14750	000077	006213	054427	021000	034110	162640	173000	101015	.?..Y..".8He v...
14760	000412	040417	021000	025001	006230	000407	151400	151400	..A..*.....S.S.
14770	014410	000771	034407	001401	155000	030120	002403	000152	...y9...Z.0P....
15000	000000	000000	000000	006524	044105	051105	020111	051440	THERE IS
15010	047117	020103	052522	051105	047124	020122	042515	040520	NO CURRENT REMAP
15020	020101	051105	040415	051125	047040	043125	046114	020111	AREA.RUN FULL T
15030	047111	052040	052117	020105	051524	040502	046111	051510	NIT TO ESTABLISE
15040	020117	047105	006400	006504	047440	054517	052440	053511	ONE...DO YOU WI
15050	051510	020124	047440	042105	041514	040522	042440	040516	SH TO DECLARE AN
15060	054440	041114	047503	045523	020102	040504	006524	044101	Y BLOCKS BAD.THA
15070	052040	040522	042440	047117	052040	040514	051105	040504	T ARE NOT ALREAL
15100	054440	044516	020124	044105	020102	040504	020102	046117	Y IN THE BAD BLO
15110	041513	020124	040502	046105	037440	000000	006504	042506	CK TABLE? ...DEF
15120	040525	046124	020122	042515	040520	020101	051105	040440	AULT REMAP AREA
15130	051511	055105	020111	051440	057104	020102	046117	041513	SIZE IS ^D BLOCK
15140	024123	024440	046117	047107	006511	052040	047105	042504	(S) LONG.IT NEED
15150	051440	052117	020102	042440	040524	020114	042501	051524	S TO BE AT LEAST
15160	020136	042040	041114	047503	045450	051451	020114	047516	^D BLOCK(S) LOW
15170	043415	000000	006522	042515	040520	020101	051105	040440	G....REMAP AREA
15200	051511	055105	020050	052131	050105	020122	042524	052522	SIZE (TYPE RETUR
15210	047040	043117	051040	042105	043101	052514	052051	020077	N FOR DEFAULT) ?
15220	020000	006516	047440	051117	047515	020106	047522	020102	..NO ROOM FOR B
15230	040504	020102	046117	041513	020122	042515	040520	020101	AD BLOCK REMAP A
15240	051105	040415	042125	042440	052117	020124	047517	020115	REA.DUE TO TOO M
15250	040516	054440	041101	042040	041114	047503	045523	020055	ANY BAD BLOCKS -
15260	020101	041117	051124	044516	043415	000000	006511	046114	ABORTING....ILL
15270	042507	040514	020122	042515	040520	020101	051105	040440	EGAL REMAP AREA
15300	051511	055105	006400	006522	042515	040520	020101	051105	SIZE...REMAP ARE
15310	040440	051524	040522	052040	041114	047503	045440	047125	A START BLOCK NU
15320	046502	042522	020050	052131	050105	020122	042524	052522	MBER (TYPE RETUR
15330	047040	043117	051040	042105	043101	052514	052051	020077	N FOR DEFAULT) ?
15340	020000	006511	046114	042507	040514	020122	042515	040520	..ILLEGAL REMAP
15350	020101	051105	040440	051524	040522	052040	041114	047503	AREA START BLOC
15360	045440	047125	046502	042522	006400	006502	040504	020102	K NUMBER...BAD B
15370	046117	041513	020103	047516	052101	044516	042504	020101	LOCK CONTAINED I
15400	047040	051105	046501	050040	040522	042501	020123	050101	N FOR DEFAULT) ?
15410	041511	043111	042504	006520	046105	040523	042440	051520	CIFIED.PLEASE SP

15430	042501	006400	054320	006315	000005	010133	002316	054320	EA..XP.M...[.NXI
15440	006315	000005	102400	040133	002316	054320	006315	000005	.M....@[.NXP.M.
15450	006225	006303	034416	030120	021400	041001	021401	024162	...C9.0P#.B.#.(
15460	122423	015001	000401	041002	045003	014100	014103	002316	%.....B.J..@.C.
15470	000152	054320	006315	000005	006301	033300	000156	000160	.jXP.M...A6@.n.
15500	000161	000077	024156	030121	045006	006257	033366	000421	. .?(n0QJ..6v.
15510	006273	045006	006263	125014	000410	021006	024160	122433	.;J..3*....(p%
15520	000404	024161	106432	000405	006301	033444	000077	000745	..(q.....A7\$.?.
15530	102400	041001	006241	001233	100400	041001	014100	002316	..B..!.....B..@.
15540	006504	042506	040525	046124	020106	051101	046505	020123	.DEFAULT FRAME
15550	044532	042440	044523	020136	042054	006515	044516	020111	IZE IS ^D,.MIN
15560	051440	057104	026040	040516	042040	046501	054040	044523	S ^D, AND MAX I
15570	020136	042015	000000	006504	044523	045440	043122	040515	^D....DISK FRA
15600	042440	051511	055105	020050	052131	050105	020122	042524	E SIZE (TYPE RE
15610	052522	047040	043117	051040	042105	043101	052514	052051	URN FOR DEFAULT
15620	020077	020000	006511	046114	042507	040514	020106	051101	? ..ILLEGAL FR
15630	046505	020123	044532	042415	000000	054320	006315	000005	ME SIZE...XP.M.
15640	006224	006303	006301	033716	000164	000067	000077	006301	...C.A7N.t.7.?.
15650	033752	001241	001636	001634	000077	030120	021000	024110	7j.!.....?0P..(
15660	122640	101015	000456	040115	006301	034066	000115	000077	%QM.A86.M
15670	020144	101015	000404	006301	034122	000077	006301	034156	d.....A8R.?A8
15700	000077	024110	133000	050426	020144	101015	000421	030422	..?(H6.Q. d....1.
15710	021000	025001	030145	006254	040431	030144	006253	044427	..*.0e.,A.0d.+I.
15720	040424	006301	034200	015744	015745	015746	000077	006301	A..A8..d.e.f.?.
15730	034220	000000	000077	010776	010775	014115	000746	002316	8....?.....M.f.
15740	006301	034224	000077	002316	000000	000000	000000	006536	.A8..?N.....
15750	052040	042111	051513	020104	051111	053105	020117	047040	T DISK DRIVE ON
15760	052516	044524	020136	052015	000000	043122	040515	042440	UNIT ^T...FRAME
15770	051511	055105	020075	020136	042040	020040	020122	042515	SIZE = ^D RE
16000	040520	020101	051105	040440	051511	055105	020075	020136	AP AREA SIZE =
16010	042015	051105	046501	050040	040522	042501	020123	052101	D.REMAP AREA ST
16020	051124	020102	046117	041513	020116	052515	041105	051040	RT BLOCK NUMBER
16030	036440	057120	006400	047125	046502	042522	020117	043040	= ^P..NUMBER OF
16040	041101	042040	041114	047503	045523	020075	020136	042015	BAD BLOCKS = ^D.
16050	006400	020110	042501	042040	020040	051505	041524	047522	.. HEAD SECTO
16060	020040	041531	046111	047104	042522	020057	020000	041101	CYLINDER / .BA
16070	042040	041114	047503	045440	047125	046502	042522	006400	D BLOCK NUMBER..
16100	057117	020040	057117	020040	057117	020040	020057	020000	^O ^O ^O /.
16110	057120	006400	052110	042522	042440	040522	042440	047117	^P..THERE ARE NC
16120	020102	040504	020102	046117	041513	051415	000000	054320	BAD BLOCKS...XP
16130	006315	000005	006257	025340	000401	040431	006260	017620	.M.../*...A..0..
16140	000422	006252	000142	000010	020422	030422	006276	000403	...*.b..!1..>..
16150	126520	044127	020414	006260	017747	000405	006252	000152	-PHW!...0.g...*..
16160	000013	002316	006301	034366	000077	000745	000000	034360	...N.A8v.?e..8
16170	033060	031470	000000	006525	047113	047117	053516	020104	6038...UNKNOWN
16200	051111	053105	020124	054520	042400	054320	006315	000005	RIVE TYPE.XP.M.
16210	020121	024124	030123	006054	002316	020120	006055	002316	Q(T0S.,N P.-N
16220	030123	006062	034041	011400	002316	054320	006315	000005	0S.28!...NXP.M.
16230	102400	006240	001233	000400	020141	006252	001233	000010	a.*....
16240	006226	020121	024124	030123	006052	002316	020120	024124	.. Q(T0S.*.N P(I
16250	030123	006053	002316	030123	006062	024124	030123	006245	0S.+N0S.2(T0S.2
16260	002316	034041	011400	002316	054320	006315	000005	102400	.N8!...NXP.M....
16270	006240	001633	000400	030120	024110	045000	002316	054320	0P(HJ..NXP
16300	006315	000005	006271	044074	050073	006263	125015	000450	.M...9H<P;.3*..(
16310	030457	132414	000447	006271	044454	006263	030451	132414	1/5...9I,.31)5.
16320	000441	006271	044073	006263	125014	000434	020074	024144	!.9H;.3*....<(d
16330	125015	000430	106033	000426	030073	020154	142033	000422	*.....0; 1D...
16340	024144	006255	020074	107000	030145	006255	040073	020421	(d.- <..0e.-@;!.
16350	030145	112033	000407	107020	044074	101012	010073	006234	0e.....H<...;..
16360	000405	006301	034762	000077	002316	011400	002316	000054	...A9r.?N...N.
16370	000000	006511	046114	042507	040514	020104	044523	045440	...ILLEGAL DISK
16400	041114	047503	045440	047125	046502	042522	006400	054320	BLOCK NUMBER..XP
16410	006315	000005	030120	011400	021001	025002	101015	125015	M...0P...*...*
16420	101011	002316	021002	025775	106420	045401	102560	025015	ATA CORPORATION+
16430	107000	021001	106014	002316	021401	025003	122432	002316	N#.*%..N

16450	000401	006303	030121	006241	001233	101014	000435	021002	...C0Q...!
16460	024144	106404	000431	021003	024145	106404	000425	011400	(d....(e....
16470	021000	101015	002316	006246	000104	001633	000401	006303	...N.&D....
16500	030120	021000	024211	106433	000500	024110	122423	000475	0P".(....@(%...
16510	101212	000473	002316	006246	000106	001233	000401	006303	...;N.&F....
16520	021000	100234	000456	021001	101014	000453	021003	101014	...+...
16530	000450	020157	101015	000445	021000	126120	123000	041000	.(o...%";P&.B
16540	020157	041021	102400	041022	006247	000106	001233	000401	oB...B...F...
16550	006303	102400	006240	001233	000400	020141	006252	001233	.C... ..a*.
16560	000010	102400	041000	020157	041006	006241	001233	100400	B. oB...!
16570	041001	006247	000101	001233	000401	006303	011400	002316	B...'.A.....C...
16600	006301	035422	000077	002316	006301	035464	000077	015400	.A;...?.N.A;4.?
16610	002316	006504	044523	045440	044504	020111	051440	044516	.N.DISK ID IS I
16620	041517	051122	042503	052040	026440	040502	047522	052111	CORRECT - ABORT
16630	047107	006400	006502	040504	020102	046117	041513	020114	NG...BAD BLOCK
16640	044523	052040	044523	020103	047522	051125	050124	020055	IST IS CORRUPT
16650	020101	041117	051124	044516	043415	000000	054320	006315	ABORTING...XP.
16660	000005	030120	021001	025002	101015	125014	101011	002316	..0P".*...*
16670	040073	044074	020115	101125	002316	126520	030125	045003	@;H< M.U.N-P0UJ
16700	030120	025000	106400	020120	133000	050407	030110	146640	0P*... P6.Q.0HM
16710	044076	006237	000401	006246	000000	002233	000401	000401	H>.....&.....
16720	006247	000073	002233	006305	000401	010767	010766	006237	.';...E...w.v.
16730	000401	014115	000761	002316	054320	006315	000005	102400	...M.q.NXP.M...
16740	040073	040074	002316	054320	006315	000005	000433	054320	@;@<.NXP.M....X
16750	006315	000005	020073	040404	020074	040403	002316	000000	.M..;A.<A..N..
16760	000000	054320	006315	000005	020773	040073	020772	040074	..XP.M..!@;!@<
16770	002316	054320	006315	000005	024074	020076	107022	010073	.NXP.M..(<>...
17000	044074	020073	024152	122433	002316	122414	000404	020074	H<;(j%.N%...
17010	024153	106033	011400	002316	054320	006315	000005	031400	(k.....NXP.M..3.
17020	025000	044413	011400	031400	025000	045401	011400	042405	*.I...3.*.K...E.
17030	010404	015401	000775	002316	000000	054320	006315	000005	N..XP.M..
17040	031400	021000	040414	011400	020126	041401	102400	026407	3."A... VC...-
17050	010406	123000	015401	000774	041774	002316	000000	054320	..&.....C..N..X
17060	006315	000005	024122	044425	024076	044424	126520	044076	.M..(RI.(>I.-PH
17070	024126	044421	026416	010415	106414	002316	014414	000773	(VI.-.....N....
17100	006237	000401	014407	000765	102400	040076	011400	002316	u..@>...
17110	000000	000000	000000	101021	101040	054320	006315	000005	XP.M..
17120	102560	040077	002316	054320	006315	000005	030123	024124	.p@?.NXP.M..0S(T
17130	006051	002316	034041	011400	002316	101021	101040	040513	.)N8!...N... AR
17140	102560	040512	020510	054320	006315	000005	014075	000402	.pAJ!HXP.M...=.
17150	006244	102400	040076	040130	031400	031000	034125	021000	\$.@>@X3.2.8U"
17160	041401	021001	041402	034041	011400	024124	030125	020077	C..C.8!..(T0U
17170	101005	000403	020200	000402	102520	041003	031400	021000	PB.3..
17200	011400	040451	030125	020450	101004	000411	020133	101014	..A)0U!(....[.
17210	006250	020441	006057	000413	021003	000476	020133	101014	.(!!./...">[.
17220	006250	020431	006060	000403	021003	000466	040424	030124	.(!..0..."6A.0T
17230	021003	024076	107000	044076	021000	024465	106405	000415	..(>..H>".)5...
17240	024132	125004	002316	024462	106405	000437	024455	106405	(Z*..N)2....)-.
17250	000404	002316	000000	000000	021003	030125	025003	106400	...N.....0U*...
17260	045003	025002	107022	011001	045002	020765	030124	025003	J.*.....J.!u0T*
17270	125300	123000	040760	024124	030125	020756	101004	000403	*@&.Ap(T0U!n...
17300	020752	000705	020750	000713	006234	000411	002316	024076	!j.E!h.K.....N(>
17310	125005	002316	000404	024076	107000	044076	034041	011400	*..N..(>..H>8!..
17320	011400	002316	000240	000237	000202	000241	054320	006315	...N. ....!XP.M
17330	000005	024124	030123	006061	000401	030124	021004	040134	..(T0S.1...0T".@
17340	021005	040135	021006	040136	021007	040137	002316	054320	..@]"..@~".@_NXP
17350	006315	000005	006301	037212	000077	102520	040501	030477	.M...A>..?.PAA1?
17360	021000	024501	106415	000442	006301	037150	000134	000135	..)A...".A>h.\.]
17370	000136	000077	030464	021000	024464	106414	000405	006301	..?14"...4.....A
17400	037256	000137	000077	020454	101015	002316	102400	040450	>...?!....N..A(
17410	006301	037300	000077	030124	021004	040134	021005	040135	..A>@..?0T".@\". @]
17420	021006	040136	021007	040137	000740	006301	037344	000134	..@~".@_".A>d.\
17430	000077	006301	037376	000136	000137	000077	020421	101015	?A>...?!....?
17440	002316	102400	040415	030124	021004	040134	021006	040135	..N CORPORATION@
17450	021007	040137	006301	037300	000077	000750	012331	000000	..@_A>@..?.h.Y..

17470	057117	026040	042111	041040	036440	057117	026040	042111	0, DIB = 0, DI
17500	041440	036440	057117	005015	000000	005015	051524	040524	C = 0.....STAY
17510	052523	020102	042506	047522	042440	046101	051524	020111	US BEFORE LAST
17520	027517	020117	050105	051101	052111	047516	035000	005015	/O OPERATION:...
17530	040514	052115	047504	042440	030440	036440	057117	000000	ALTMODE 1 = 0.
17540	005015	051524	040524	052523	020101	043124	042522	020114	..STATUS AFTER
17550	040523	052040	044457	047440	047520	042522	040524	044517	AST I/O OPERATI
17560	047072	000000	005015	050101	041513	042524	020123	052101	N:....PACKET STA
17570	052125	051440	053517	051104	020075	020136	047400	005015	TUS WORD = 0..
17600	042111	041440	036440	057117	026040	046505	046517	051131	DIC = 0, MEMORY
17610	020101	042104	051105	051523	020075	020136	047412	006400	ADDRESS = 0..
17620	040174	031462	040342	031462	040202	031462	040210	031462	@.32@b32@.32@.32
17630	040216	031472	040224	031502	040352	031502	040232	031532	@.3:@.3B@j3B@.32
17640	040360	031532	040240	031512	040406	031512	040522	031512	@p3Z@ 3JA.3JAR3J
17650	040432	031512	040442	031512	040326	031522	040420	031522	A.3JA"3J@V3RA.3J
17660	040334	031522	040246	031452	040254	031452	040262	031452	@\3R@&3*@.3*@23*
17670	040270	031452	040276	031452	040304	031452	040312	031452	@83*@>3*@D3*@J3*
17700	040320	031452	040366	031452	040400	031452	040450	031542	@P3*@v3*A.3*A(3J
17710	040456	031542	040464	031552	040506	031562	040472	031572	A.3bA43jAF3rA:3.
17720	040500	031602	040514	031612	040534	031612	040544	031622	AQ3.AL3.A\3.Ad3.
17730	040552	031622	040626	031652	040620	031652	040560	031632	Aj3.A.3*A.3*Ap3.
17740	040566	031632	040602	031642	040610	031642	177777	040174	Av3.A.3"A.3".@.
17750	020316	040342	020316	040202	020316	040210	020316	040216	N@b N@. N@. N@.
17760	020343	040224	020361	040352	020361	040232	020377	040360	c@. q@j q@. @j
17770	020377	040240	020415	040406	020415	040522	020415	040432	.@!.A!.A!.AR!.A.
20000	020415	040442	020415	040326	020433	040420	020433	040334	!.A"!.@V!.A!.@V
20010	020433	040246	020460	040254	020460	040262	020460	040270	!.Q&!0@,!0@2!0@E
20020	020460	040276	020460	040304	020460	040312	020460	040320	!0@>!0@D!0@J!0@E
20030	020460	040366	020460	040400	020460	040450	020505	040456	!0@v!0A.!0A(!EA.
20040	020505	040464	020532	040506	020557	040472	020604	040500	!EA4!ZAF!oA!:!AG
20050	020630	040514	020654	040534	020654	040544	020701	040552	!.AL!,A\!,Ad!AA
20060	020701	040626	020724	040620	020724	040560	020747	040566	!AA.!TA.!TAp!gA
20070	020747	040602	021002	040610	021002	177777	032060	032067	!gA."A"...4047
20100	000000	032062	031467	000000	032062	031470	000000	032060	..4237..4238..42
20110	032070	000000	032060	032467	000000	032062	031461	000000	48..4057..4231..
20120	032062	031464	000000	033060	030061	000000	033060	030062	4234..6001..6002
20130	000000	033060	033063	000000	033060	030064	000000	033060	..6003..6004..60
20140	030065	000000	033060	030066	000000	033060	030067	000000	05..6006..6007..
20150	033060	030070	000000	033060	031460	000000	033060	031470	6008..6030..6038
20160	000000	042111	040502	046117	000000	031063	030464	000000	..DIABLO..2314..
20170	031463	031460	000000	047117	053101	042111	051513	000000	3330..NOVADISK..
20200	043111	054105	042000	042111	040502	046117	032064	000000	FIXED.DIABLO44..
20210	042111	051513	042524	052105	000000	050110	047505	047111	DISKETTE..PHOENI
20220	054000	033060	032065	000000	033060	033060	000000	055105	X.6045..6060..ZE
20230	041122	040400	033060	033061	000000	033060	033063	000000	BRA.6061..6063..
20240	033060	033064	000000	033060	033067	000000	033060	033460	6064..6067..6072
20250	000000	052117	050114	047501	042105	051000	043505	046511	..TOPLOADER.GEMI
20260	047111	000000	033060	034471	000000	042503	044117	000000	NI..6099..ECHO..
20270	033060	034467	000000	042104	020104	044523	045505	052124	6097..DD DISKETI
20300	042400	033061	031062	000000	053125	046103	040516	000000	E.6122..VULCAN..
20310	042105	041510	047400	033061	030063	000000	000000	011410	DECHO.6103.....
20320	000313	000030	000045	000141	000001	000626	000014	000000	.K...%.a.....
20330	040662	032060	032067	027464	030064	033457	032062	031467	A24047/4047/4237
20340	027464	031063	034000	000000	027624	000313	000074	000065	/4238.../.K.<.E
20350	000301	000001	003756	000006	000000	040734	032060	032070	.A...n....A\404E
20360	000000	000000	137120	000313	000360	000123	001405	000001	>P.K.p.S....
20370	007734	000014	000000	040770	032060	032467	000000	000002	.\....Ax4057....
20400	136627	000633	000665	000123	000177	000001	017201	000056	=....5.S.....
20410	000000	041024	032062	031461	000000	000000	023100	000630	..B.4231....&@..
20420	000030	000065	000000	000001	001460	000014	000002	041060	...5.....0....B2
20430	033060	032065	000000	000000	001150	000115	000010	000005	6045.....h.M....
20440	000000	000001	000115	000010	000000	041114	033060	031460	M.....BL6030
20450	027466	030063	034040	042111	051513	042524	052105	000000	6038 DISKETTE..
20460	000000	017777	000000	000010	021027	021050	000001	002000	..CORROATION..
20470	000010	000000	041166	033060	030061	026466	030060	034040	...Rv6001-6008

20510	000710	000123	000000	000001	017201	000060	000000	041240	H.S.....0..B
20520	033060	033060	020050	034466	020115	042507	040502	054524	6060 (96 MEGABYTE)
20530	042451	000000	000005	125670	001457	000710	000161	000000	E)....+8./..H. .
20540	000001	036175	000140	000000	041312	033060	033061	020050	..<...BJ6061
20550	030471	031040	046505	043501	041131	052105	024400	000001	192 MEGABYTE)...
20560	077010	001457	000170	000123	000000	000001	007753	000060	.../.x.S.....k.
20570	000000	041364	033060	033067	020050	032460	020115	042507	..Bt6067 (50 MEG
20600	040502	054524	042451	000000	000000	004000	000000	000040	ABYTE).....
20610	000045	000000	000001	001460	000014	000000	041436	033060	%......0.....C.60
20620	033063	020050	030440	046505	043501	041131	052105	024400	63 (1 MEGABYTE).
20630	000000	010000	000000	000040	000045	000000	000001	001460	%......
20640	000014	000000	041506	033060	033064	020050	031040	046505	CF6064 (2 M
20650	043501	041131	052105	024400	000000	046200	000630	000060	GABYTE)....L....
20660	000123	177777	000001	001460	000060	000000	041556	033060	.S.....0.0..Cn60
20670	033460	020050	031060	020115	042507	040502	054524	042451	70 (20 MEGABYTE)
20700	000000	000000	060000	000300	000200	000065	000000	000001	\..@...5....
20710	001400	000100	000000	041630	033060	034471	020050	030462	...@...C.6099 (12
20720	027065	020115	041051	000000	000000	140000	000300	000400	.5 MB)....@...@..
20730	000065	000000	000001	003000	000100	000000	041676	033061	.5.....@...C>61
20740	030063	020050	031065	027060	020115	041056	024400	000000	03 (25.0 MB.)...
20750	004640	000115	000040	000005	000000	000001	000232	000040	. .M.
20760	000000	041744	033060	034467	020050	042117	052502	046105	..Cd6097 (DOUBL
20770	020104	042516	051511	052131	020104	044523	045505	052124	DENSITY DISKET
21000	042451	000000	000010	042427	001457	001231	000177	000000	E)....E.../.....
21010	000001	036175	000176	000000	042032	033061	031062	020050	..<.....D.6122 (
21020	031067	033440	046505	043501	041131	052105	024400	000001	277 MEGABYTE)...
21030	000003	000005	000007	000013	000015	000021	000023	000027	.....
21040	000035	000037	000045	000051	000053	000057	000065	000065	%.)+. /.5.E
21050	000001	000007	000015	000027	000037	000051	000057	000065	). /.E
21060	000075	000107	000117	000131	000141	000147	000161	000161	..=.G.O.Y.a.g..q..
21070	000177	054320	006315	000005	040423	031400	021000	040417	..XP.M..A.3..A.
21100	011400	031400	021000	041401	011400	022412	010411	042407	..3..C...%...E.
21110	010406	015401	000773	020404	041774	002316	000000	000000	!C..N....
21120	102400	054416	142432	000412	034414	125120	101100	142412	..Y.E...9.*P.CE
21130	142400	125100	175404	000773	175021	175040	002401	000000	E.*@.....
21140	177760	102460	054411	034775	125203	101201	143220	175404	.p.OY.9.*...F...
21150	000774	125260	002401	000000	054320	006315	000005	031400	..*0....XP.M..3.
21160	021000	006277	020117	006017	015401	006307	034041	041774	..? 0.....G8!C.
21170	044420	011400	111000	006263	034201	166032	006264	014411	I.....38.1..4..
21200	000773	126400	006264	020117	006263	125014	011400	002316	..-..4 0.3*.....N
21210	000000	054320	006315	000005	031400	025000	011400	135000	..XP.M..3.*.....
21220	031400	150015	000411	165400	125400	006276	000771	131000	3.P...k.+...>.y2.
21230	021377	041774	011400	002316	054320	006315	000005	031400	..C....NXP.M..3.
21240	031000	011400	050070	006017	014477	006307	034040	002316	2...P8...?.G8 .N
21250	054417	006017	005000	000401	020412	040040	034064	030165	Y.....!.@ 840
21260	102400	041400	175400	112004	000775	002402	000546	000000	..C.....f..
21270	054320	006315	000005	011774	111220	025000	020210	101003	XP.M.....*..
21300	125300	107400	045775	002316	054320	006315	000005	020210	*@...K..NXP.M...
21310	107400	011776	155223	125300	031400	151002	101300	143400	Z.*@3.R..@G.
21320	123000	041400	002316	054320	006315	000005	021000	100014	S.C..NXP.M... ..
21330	122405	000404	151400	151400	000772	051776	002316	054320	%...S.S...S..NXP
21340	006315	000005	006263	125005	000403	006264	000774	051776	.M...3*....4..S.
21350	006264	041774	002316	054320	006315	000005	020421	040417	.4C..NXP.M..!.A.
21360	121000	024204	010414	032413	151005	002316	142422	125401	..(....5.R..NE.+.
21370	143001	000775	031776	011776	006264	000764	000000	021377	F...3....4.t...
21400	100000	010000	001000	000100	000010	000001	000000	054320	@.....XP
21410	006315	000005	040435	044435	101015	000741	024176	044426	.M..A.I....a(.I.
21420	024165	044425	024425	034425	102400	175120	125100	101100	(uI.).9....P*@.e
21430	014416	000774	044415	054415	024204	107000	006264	024166	I.Y.(....4(v
21440	044406	014404	000760	051776	002316	000013	000003	000000	I....pS..N.....
21450	000000	054320	006315	000005	126400	152400	051776	045775	..XP.M..-U.S.K.
21460	006263	034172	030204	146422	136433	002316	034041	011774	.38.0.M.=..N8!..
21470	031776	035775	175120	151100	175120	151100	175120	151100	S.;...PRC.PRC.PRC
21500	167000	034041	000754	054320	006315	000005	031400	031400	..E.....150!..
21510	011400	020177	142640	101003	004427	030444	050441	121000	..E.....150!..

21530	032427	151005	002316	142422	125401	143001	000775	031776	5.R..NE..+..F...3.
21540	006264	051776	000764	054415	121000	024202	101132	024203	.4S..tY..(..Z(
21550	031776	006264	011776	101132	104401	105000	002402	000000	3..4...Z.....
21560	000000	021561	023420	001750	000144	000012	000001	000000	..#q'..h.d.....
21570	000001	000000	054320	006315	000005	152400	050444	050444	XP.M..U.Q\$Q\$
21600	006263	030202	132405	000405	151400	151405	044434	151005	.30.5...S.S.I.R.
21610	006263	034174	030204	146422	136433	000405	030425	004414	.38.0.M.=...1..
21620	050423	000767	034041	041774	015774	024416	020414	101004	Q..w8!C...).!..
21630	124400	045775	002316	054406	155120	175120	173120	133000	).K..NY.ZP.PvP6
21640	002401	000000	000000	000000	101021	101040	054320	006315	XP.M
21650	000005	031400	031000	011400	101002	000410	004416	030172	..3.2.....0
21660	101132	000433	034041	011400	002316	004407	030173	101232	.Z..8!...N..0..
21670	000424	034041	011400	002316	054423	034064	157000	041400	..8!...NY.84^..C
21700	151123	126400	151220	006017	014077	000407	006017	013477	RS-.R....?.....?
21710	000404	034041	041775	002404	034041	051776	002316	000000	..8!C...8!S..N..
21720	054320	006315	000005	040420	050420	006263	131000	020415	XP.M..A.Q..32.!.
21730	006263	132404	002316	125005	000405	010406	010406	020404	.35..N*.....!
21740	000765	011400	002316	000000	000000	054320	006315	000005	.u...N....XP.M..
21750	006263	011774	125005	002316	006300	000773	054320	006315	.3..*..N.Q..XP.M
21760	000005	121000	006017	010000	000401	034040	030177	024175	8 0.(
21770	142415	000770	002316	054320	006315	000005	152400	050473	E..x.NXP.M..U.Q
22000	031400	021000	030547	011400	050467	006263	125005	000500	3..1g..Q7.3*...3
22010	030207	146414	000405	030517	006263	006265	003001	030454	0.M...10.3.5..1,
22020	006264	000763	054320	006315	000005	054445	000752	004446	.4.sXP.M..Y%.j..
22030	006272	000000	000752	004442	006267	000747	004437	000761	j..7.g....
22040	004435	040433	121000	024313	146433	000442	006263	125005	..A..(KM...3*..
22050	000413	006264	000771	040421	031400	031000	021000	025001	...4.yA.3.2..*..
22060	011400	030412	006270	020411	000720	004410	125300	006264	..1..8!..P..*@.4
22070	125300	000727	000000	000000	000000	054411	034041	031400	*@.W.....Y.8!3.
22100	031000	025000	011400	030770	034040	002401	000000	024763	2.*...1x8 ....)s
22110	125004	000555	126400	006264	031400	031000	011400	020432	*..m-..43.2...!
22120	024205	132415	000406	050070	006017	017077	006307	002316	(.5...P8...?..G..N
22130	006277	002316	022133	000104	022027	000101	022036	000127	.?..N\$[.D\$.A\$...W
22140	022065	000124	022040	000117	022033	000120	022053	177777	\$5.T\$.0\$...P\$+..
22150	006307	044324	000000	000000	000000	000000	000000	000000	.GHT.....
22160	000000	000000	000000	000000	000000	000000	000000	000000	.....

22260	000000	000000	000000	000000	000000	044536	030605	020662	I~1.!2
22270	112400	145000	031400	031000	011400	006017	016477	006307	..J.3.2.....?..G
22300	002316	054320	006315	000005	020133	101014	006251	030124	.NXP.M.. [...])OT
22310	021001	006277	006301	044634	000077	002212	005015	050122	"..?..AI..?....PR
22320	047507	051101	046440	041501	047116	047524	020103	047516	OGRAM CANNOT CON
22330	052111	047125	042440	026455	020101	041117	051124	044516	TINUE -- ABORTIN
22340	043440	005015	000000	054320	006315	000005	002401	022565	G ....XP.M....%u
22350	054320	006315	000005	020314	142415	000421	020133	101014	XP.M.. LE... [..
22360	006251	030125	021003	126520	122415	000404	040075	006243	.)OU".-P%...@=#
22370	002316	006237	000401	102520	040076	000404	020536	152000	.N.....PQ>..!~T.
22400	000536	030124	025000	021001	030407	006265	031001	151014	^OT*..1..52.R.
22410	000526	131000	006307	022414	000200	177777	000201	177777	.V2..G%.....
22420	000202	177777	000203	177777	000204	177777	000205	177777	.....
22430	000206	177777	000207	177777	000210	177777	000211	000001	.....
22440	000212	177777	000213	000001	000214	000001	000215	000001	.....
22450	000216	000001	000217	000001	000220	000001	000221	000001	.....
22460	000222	000001	000223	000001	000224	000001	000225	000001	.....
22470	000226	000001	000227	000001	000230	177777	000231	000001	.....
22500	000232	000001	000233	000001	000234	000001	000235	000001	.....
22510	000236	000001	000237	177777	000240	177777	000241	000001	!
22520	000242	000001	000243	000001	000244	000001	000245	177777	..#...\$...%..
22530	001000	177777	177777	000000	045530	000000	040777	006301	KX..A..L
22540	045554	022535	000073	000077	150014	006212	020073	024074	K1%].;?P...;(K
22550	006230	000475	020073	101014	000411	020074	024111	106433	...=;....<(I..
22560	000405	006301	045652	000077	010112	030120	021000	101015	...AK*..?..J0P"...
22570	000445	155000	117000	020110	113000	156033	000414	020000	%Z...H..\\...;
22600	025000	106414	000405	020074	025001	106415	000421	151000	*.CORPORATIONS.
22610	151400	000764	020073	041400	024074	045401	175400	175400	S..t;C.(K.....

22630	040075	006244	034041	011400	002316	010113	020113	024114	Q=.\$8!...N.K K(L
22640	106432	000766	006301	045600	000077	000404	006301	045744	...v.AK...?...AKd
22650	000077	006245	000401	006213	042101	052101	020103	047515	?.%....DATA COM
22660	050101	051105	020105	051122	047522	000000	057124	020055	PARE ERROR..^T
22670	020102	040504	020102	046117	041513	036536	050015	000000	BAD BLOCK=^P...
22700	006452	025052	020124	047517	020115	040516	054440	041101	*** TOO MANY BA
22710	042040	041114	047503	045523	020055	020101	041117	051124	D BLOCKS - ABORT
22720	044516	043440	025052	025015	000000	025052	025040	053501	ING ***...*** WA
22730	051116	044516	043440	026440	051104	047523	020103	040516	RNING - RDOS CAN
22740	047117	052040	041105	020122	052516	020127	044524	044040	NOT BE RUN WITH
22750	052110	044523	020102	046117	041513	020102	040504	020052	THIS BLOCK BAD *
22760	025052	006400	041101	042040	041114	047503	045440	044523	**..BAD BLOCK IS
22770	020111	047040	042111	051513	020102	040504	020102	046117	IN DISK BAD BLO
23000	041513	020122	042515	040520	020101	051105	040415	041517	CK REMAP AREA.CO
23010	046520	046105	052105	020111	047111	052040	051525	043507	MLETE INIT SUGG
23020	042523	052105	042040	026440	040502	047522	052111	047107	ESTED - ABORTING
23030	006400	030411	050040	006301	046106	000077	006017	005000	..1.P .ALF.?....
23040	000401	063077	000546	051524	040503	045440	047526	042522	..f?.fSTACK OVER
23050	043114	047527	020055	026440	044101	046124	044516	043440	FLOW -- HALTING
23060	006412	000000	025776	044070	040466	044466	050466	054466	+.H8A6I6Q6Y6
23070	000411	040461	044461	050461	054461	054320	006315	000005	..A1I1Q1Y1XP.M..
23100	126001	126400	044447	034452	021775	024442	122404	000406	..-.I'9*#.)"%...
23110	021776	040446	024205	123400	122415	020070	040440	030064	#.AS(.'.%. 8A 04
23120	113000	021000	040431	030445	024430	006265	035001	021400	..".A.1%)).5:..#.
23130	165520	044407	126660	034415	117000	021400	040423	006301	kPI.-09...#.A..A
23140	000000	023161	000077	010406	000402	002316	006212	006017	..& .?.....N....
23150	023152	000000	000000	000001	000002	000003	000004	000005	&j.....
23160	000015	000000	006301	046354	000077	002063	044516	052000	AL1.?3INT.
23170	023172	000401	000006	023204	000022	023221	000217	023237	&.....&...&...&.
23200	000200	023253	177777	023304	000001	006505	047104	020117	..&+...&D...END 0
23210	043040	043111	046105	035040	043111	046105	020136	052015	F FILE: FILE ^T.
23220	000000	000001	006514	044516	042440	052117	047440	046117	LINE TOO LO
23230	047107	035040	043111	046105	020136	052015	000000	000001	NG: FILE ^T.....
23240	006504	042526	044503	042440	052111	046505	047525	052072	.DEVICE TIMEOUT:
23250	020136	052015	000000	000000	006525	047113	047117	053516	^T.....UNKNOWN
23260	020104	044523	045440	042522	051117	051040	026440	042111	DISK ERROR - DI
23270	051513	020123	052101	052125	051475	057117	006501	041117	SK STATUS=^O.ABO
23300	051124	044516	043415	000000	100002	006525	047113	047117	RTING.....UNKN
23310	053516	020105	051122	047522	020103	047504	042440	057117	WN ERROR CODE ^D
23320	006400	000200	042111	051513	020105	051122	047522	000000	DISK ERROR..
23330	000201	041510	042503	045523	052515	020105	051122	047522	..CHECKSUM ERROR
23340	000000	000202	042503	041440	042522	051117	051040	024103	ECC ERROR (C
23350	047522	051105	041524	042504	024400	000203	052516	041517	ORRECTED)...UNCO
23360	051122	042503	052101	041114	042440	042503	041440	042522	RRECTABLE ECC ER
23370	051117	051000	000204	053105	051111	043131	020105	051122	ROR...VERIFY ERR
23400	047522	000000	000205	041101	042040	051505	041524	047522	OR....BAD SECTOR
23410	000000	000206	050101	051111	052131	020105	051122	047522	PARITY ERROR
23420	000000	000207	042101	052101	020114	040524	042440	042522	DATA LATE ER
23430	051117	051000	000210	042101	052101	020103	044101	047116	ROR...DATA CHANN
23440	042514	020104	040524	040440	042522	051117	051000	000211	EL DATA ERROR...
23450	051505	042513	020105	051122	047522	000000	000212	040504	SEEK ERROR....AD
23460	042122	042523	051440	042522	051117	051000	000213	041531	DRESS ERROR...CY
23470	046111	047104	042522	020101	042104	051105	051523	020105	LINDER ADDRESS E
23500	051122	047522	000000	000214	051525	051106	040503	042440	ROR....SURFACE
23510	047522	020123	042503	052117	051040	040504	042122	042523	OR SECTOR ADDRES
23520	051440	042522	051117	051000	000215	042122	044526	042440	S ERROR...DRIVE
23530	052516	051501	043105	020117	051040	040504	042122	042523	UNSAFE OR ADDRES
23540	051440	042522	051117	051000	000216	042122	044526	042440	S ERROR...DRIVE
23550	052516	051501	043105	000000	000217	052111	046505	020117	UNSAFE....TIME 0
23560	052524	000000	000220	044101	051104	053501	051105	020124	UT....HARDWARE T
23570	044515	042440	047525	052000	000221	042125	040514	020120	IME OUT...DUAL P
23600	051117	041505	051523	047522	020117	050105	051101	052111	ROCESSOR OPERATI
23610	047516	020116	047524	020123	052520	050117	051124	042111	ON NOT SUPPORTED
23620	000000	000222	044516	041517	051122	042503	052040	042111	CONFIRMATION DI
23630	051513	020124	054520	042400	000223	044514	046105	043501	SK TYPE...TTTREGA

23650	040522	042451	000000	000224	047117	020123	052503	044040	ARE)...NO SUCH
23660	052122	040503	045400	000225	040524	052105	046520	052105	TRACK...ATTEMPT
23670	042040	053522	044524	042440	052117	020127	051111	052105	D WRITE TO WRITE
23700	026504	044523	040502	046105	042040	042122	044526	042400	-DISABLED DRIVE.
23710	000226	042122	044526	042440	052516	051501	043105	020117	..DRIVE UNSAFE
23720	051040	053522	044524	042440	052117	020127	051111	052105	R WRITE TO WRITE
23730	026504	044523	040502	046105	042040	042122	044526	042400	-DISABLED DRIVE.
23740	000227	053522	044524	042440	046117	041513	042504	020101	..WRITE LOCKED
23750	051105	040400	000230	044516	041517	046520	046105	052105	REA...INCOMPLETE
23760	020124	051101	047123	043105	051000	000231	041517	047124	TRANSFER...CONT
23770	051117	046114	042522	020117	053105	051127	051111	052105	ROLLER OVERWRITE
24000	020111	047040	046505	046517	051131	020102	042531	047516	IN MEMORY BEYON
24010	042040	042516	042040	047506	020102	052506	043105	051000	D END OF BUFFER.
24020	000232	044516	041517	051122	042503	052040	046505	046440	..INCORRECT MEM
24030	040504	042122	020046	027517	051040	051505	041524	047522	ADDR S/OR SECTOR
24040	020103	047124	020106	051117	046440	041517	047124	051117	CNT FROM CONTRO
24050	046114	042522	000000	000233	053522	044524	042440	043101	LLER....WRITE FA
24060	052514	052000	000234	052516	042105	051055	053117	046124	ULT...UNDER-VOLT
24070	040507	042440	043101	052514	052000	000235	050117	051511	AGE FAULT...POST
24100	052111	047516	042522	020106	040525	046124	000000	000236	TIONER FAULT....
24110	051505	051126	047440	041514	047503	045440	043101	052514	SERVO CLOCK FAUL
24120	052000	000237	052122	040503	045440	041117	052516	042101	T...TRACK BOUNDA
24130	051131	000000	000240	041114	047503	045440	041517	052516	RY... BLOCK COUN
24140	052040	052117	047440	041111	043400	000241	044514	046105	T TOO BIG...!ILLE
24150	043501	046040	042111	051513	020101	042104	051105	051523	GAL DISK ADDRESS
24160	000000	000242	044516	053101	046111	042040	042105	053111	..."INVALID DEVI
24170	041505	020116	040515	042400	000243	044516	053101	046111	CE NAME...#INVALI
24200	042040	042111	051513	020111	042040	041114	047503	045400	D DISK ID BLOCK.
24210	000244	044516	053101	046111	042040	041101	042040	041114	.\$INVALID BAD BL
24220	047503	045440	052101	041114	042400	000245	047117	052040	OCK TABLE...%NOT
24230	040440	052117	050040	046117	040504	042522	000000	034041	A TOP LOADER..8!
24240	002317	010040	056040	034041	063477	176401	176520	060277	.0. \ 8!g?...P?
24250	054411	002521	010040	056040	034041	034404	175212	060177	Y..Q. \ 8!9....
24260	002512	000000	030041	031375	020507	041002	000407	054320	.J..0!2!GB...XP
24270	006315	000000	021400	011400	115000	152401	030476	035400	.M...#.....U.1>;
24300	021400	165520	034041	035775	041400	045401	021402	143415	#.kP8!;.C.K.#.G.
24310	143000	041402	002316	054320	006315	000000	031775	102400	F.C..NXP.M..3..
24320	041000	041002	041003	002316	054320	006315	000000	025006	B.B.B..NXP.M..*
24330	031400	031000	011400	021000	151400	151400	101015	000403	3.2...".S.S.....
24340	107415	000772	021377	041775	002316	054320	006315	000000	".C..NXP.M..
24350	025006	031400	021000	011400	123415	011400	002316	054320	*.3."...".NXP
24360	006315	000000	035400	021400	024411	123400	025001	123000	.M...;#.)'.*.&
24370	041400	002316	024237	020000	010000	177700	010040	056040	C..N(.@. \
24400	034041	124405	002423	124000	101120	000774	101041	101020	8!))...(..P...!..
24410	054320	006315	000000	031400	025000	011400	031775	021002	XP.M..3.*...3."
24420	124000	123402	122000	041002	002316	024237	042120	000000	(.'\$.B..N(.DP..
24430	100016	024437	031460	000033	033464	000073	177777	042132	..).30..74.;..DZ
24440	000040	000005	024450	031460	000027	033464	000067	177777	. ..)(30..74.7..
24450	042123	000100	000014	024461	031460	000026	033464	000066	DS.@..)130..74.6
24460	177777	042113	000020	000020	024472	030060	000020	030461	..DK....):00..11
24470	000060	177777	046520	000200	000017	024507	030460	000033	.0..MP....)G10..
24500	031462	000073	032464	000030	033466	000070	177777	042110	32.;54..76.8..DH
24510	000000	100016	024520	030060	000027	030461	000067	177777	)P00..11.7..
24520	042105	000400	000014	024531	031460	000026	033464	000066	DE....)Y30..74.6
24530	177777	042121	001000	000014	177777	031460	000026	033464	..DQ.....30..74
24540	000066	177777	054320	006315	000004	021000	006553	131300	.6..XP.M..."..k20
24550	006551	147000	041402	030532	000402	031003	150015	000524	.iN.C.1Z..2.P..T
24560	021000	106414	000773	051401	021402	006534	041402	020517	".....S.#..C!O
24570	000402	020516	113000	021000	100015	000506	034512	117400	..iN..."..F9J..
24600	162700	136436	000767	122433	000765	166400	021001	034041	e@=.w%..um.."8!
24610	031776	041001	045003	121000	035401	025402	125100	125220	3.B.J.".;+.*@*.
24620	006471	041002	034041	021402	031401	025002	125113	000447	.9B.8!#.3.*.*K.
24630	004562	030461	132414	000444	031774	031007	024455	147000	r115..\$3.2.)-0.
24640	000403	006453	024225	031776	006451	065400	034041	045000	A.A. CORPORATION
24650	126000	006444	066000	006442	065400	125112	000403	030437	..\$1..r.*.I..1

24670	034041	031404	035776	025402	147000	045402	004514	030421	8!3.;+.N.K..L1.
24700	125014	146415	000420	006411	024161	024426	000004	000002	*.M.....()....
24710	000377	024376	000106	040000	024262	024357	001000	002000	..(..FQ.(2(o....
24720	000015	025012	031776	035774	021402	041004	021403	041005	..*.3.;#.B.#.B.
24730	021407	024475	123400	034041	035401	025401	123000	034470	#.)='8!;+.&.98
24740	137404	163400	034466	137404	163400	034464	137404	034463	?..g.96?..g.94?..93
24750	174000	163400	034041	024460	107414	126401	024456	123000	x.g.8!)0..-.)&.
24760	024452	123415	000404	024452	123415	123000	041006	035774	)*'....)*'.&.B.;
24770	021404	025405	034444	167022	101400	041010	045011	025004	#.+..9\$..n...B.J.*
25000	031005	006437	031776	045007	102000	041012	102620	041014	2...3.J...B...B.
25010	011400	002316	054320	006315	000000	111220	025000	101003	...NXP.M....*
25020	125300	020416	107400	045775	011774	002316	176007	001000	*@!...K...N...
25030	000400	000200	000002	041773	000010	040000	000006	000377	C...@.....
25040	031330	054320	006315	000001	021000	024476	123000	004743	2XXP.M...")>&..c
25050	020474	122414	102401	020472	040461	020450	025775	006467	!<%...!:A1!(+..7
25060	002316	006466	002316	030453	021776	041000	021774	006461	.N.6..N1+#.B.#..1
25070	002316	111000	021006	101015	000427	020454	041401	102400	.N... ..!..C...
25100	025000	151400	123000	015401	000774	101014	000415	031776	*.S.&.....3.
25110	025775	021774	006434	002316	011400	002316	054320	006315	+.#....N...NXP.M
25120	000000	011400	002316	006427	024174	025126	000000	000000	N..(*V....
25130	000001	000010	000000	000000	000000	000000	025137	000000	*
25140	000000	000003	000001	000003	000106	040000	024542	026672	FQ.)b-
25150	025366	000400	024262	054320	006315	000000	111000	021000	*v..(2XP.M..."
25160	024577	106436	000432	024575	106433	000427	021001	025002	).....)*.
25170	031003	147022	101400	031776	031010	112433	000416	112414	2.N...3.2.....
25200	000405	031776	031011	132433	000410	031776	021774	041012	..3.2.5...3.#.B.
25210	102520	041013	011400	002316	006545	024210	054320	006315	.PB....N.e(XP.M
25220	000000	030412	035776	055000	006536	002316	031776	004724	..1.;.Z...^..N3..T
25230	002316	011400	002316	025234	000000	000000	000004	000001	.N...N*.....
25240	054320	006315	000000	102520	041013	002316	054320	006315	XP.M...PB..NXP.M
25250	000000	102400	041013	002316	054320	006315	000002	021003	B..NXP.M...
25260	031000	035774	051400	041403	034041	021013	031012	101014	2.;.S.C.8!..2..
25270	150015	000457	021000	024464	133000	122400	101220	041402	P../'..46.%...C
25300	101400	041401	000444	035776	021000	025401	122000	025001	..C..\$;..'+.\$.*
25310	035402	166422	101400	034041	101014	000427	035776	021403	;..m...8!....;.#
25320	034041	122437	000422	121005	102520	031774	041003	011400	8!%...".P3.B...
25330	125014	000417	021401	025402	106400	035000	035412	021401	*...#.+.;.#
25340	035402	167022	101400	000411	151400	151400	015401	000734	;..n....S.S....\
25350	031774	035776	021401	025402	041001	045002	002316	000004	3.;#.+.B.J..N.
25360	000400	024262	025366	006402	024145	024262	101021	101040	..(2*v..(e(2...
25370	054320	006315	000016	152560	051401	101100	101220	041402	XP.M..UpS..@..C
25400	006443	151015	000403	006441	000001	020440	163000	031776	.#R...!..! f.3.
25410	006436	000401	021003	025406	106415	000404	025775	006430	+.....+...
25420	024132	031000	021404	025010	106433	000736	106414	000405	(22.#.*.....^...
25430	021405	025011	106437	000730	021406	101015	002412	006412	#.*.....X#.....
25440	000120	002411	000411	024313	024406	000003	025254	024267	.P....(K)...*,(7
25450	026062	024345	026125	021404	025405	031007	006561	045407	,2(e,U#..+.2..qK
25460	041415	105000	031403	031005	006554	041410	045411	031403	C...3.2..1C.K.3.
25470	006536	000040	000402	000411	024533	123400	025410	106404	.^.....)['.+...
25500	024530	041410	045416	025411	006522	000400	000402	000410	)XC.K..+.R.....
25510	105000	030520	006527	030517	006524	041410	025411	031403	..1P.W10.TC..+.3.
25520	121000	006512	025660	006511	025410	123000	041413	006504	..J+0.I+.&.C..D
25530	025672	006503	025002	006473	000040	000402	123000	041412	+:.C*...;...&.C.
25540	021410	025005	106400	021406	106432	000405	121000	025775	#.*...#.....+.
25550	006465	024121	006461	025642	106432	000405	121000	025775	.5(Q.1+.....+.
25560	006455	024132	041406	006443	001400	000402	000415	105300	..-(ZC..#.....@
25570	124400	045412	100400	100000	006437	025672	006436	025002	).K.....+;..*
25600	123000	041414	000500	100400	006427	025652	123400	025412	&.C..@.....+*'.+
25610	123000	041412	006414	000040	000402	000405	021416	024413	&.C.....#.)
25620	123000	041416	006404	000200	002412	000455	024345	177737	&.C.....-(e.
25630	002000	000003	000040	024324	024376	024267	026271	031310	(T(..(7,92H
25640	031307	031330	000040	100000	000400	000001	001000	000004	2G2X.
25650	000000	100000	000040	000037	001000	140000	000000	000000	@.....
25660	000001	000005	000040	000005	000400	000005	001000	000000	.....
25670	000000	000004	000040	000005	001000	000016	000400	000016	.....

25710	000455	102620	041014	006445	001400	000402	000411	021407	-...B...%.....#.
25720	024441	123000	025414	123000	006436	061100	000425	006431	)!&.+&...b@...
25730	000040	000412	021412	006427	063000	020426	025407	004537	#...f.!.+...
25740	006422	061300	000411	020421	025002	123000	006414	061000	..b@...!.*&...b
25750	021407	006411	063300	025775	006521	000501	000407	024241	#...f@+...Q.A..(
25760	024345	006000	024357	001000	174400	021407	041014	021402	(e...(o..y.#.B.#
25770	006474	062000	025401	006472	000040	000432	021412	006465	<d.+...:..#...5
26000	063000	006464	001400	000402	000413	020461	125015	020460	f...4.....!1*...!
26010	025413	123000	025414	123000	006450	061100	000426	020451	+.&.+&...(b@...!)
26020	125015	020446	025407	004453	006440	061100	000416	020442	*.!!&+...+ b@...!
26030	125015	020441	025002	123000	006430	061000	021416	006425	*.!!*.&...b.#...
26040	063000	021412	006422	063100	021406	025402	035775	041413	f.#...f@#.+.;.C
26050	045412	165000	006421	000002	006421	000401	006416	031775	K.j.....3
26060	021000	101015	011400	002316	024357	024345	002000	000000	".....N(o(e...
26070	000400	177400	174000	024406	024252	027062	054320	006315	x.).(*.2XP.M
26100	000000	020532	123404	020531	006531	040000	000402	000405	..!Z'.!Y.Y@....
26110	006525	000001	000402	107000	021774	006520	000001	101120	.U.....#...P...P
26120	123000	024515	123000	041774	002316	006512	102400	041415	&.)M&.C..N.J..C
26130	025775	020507	123000	041407	021405	025402	035011	116437	+.!G&.C.#.+...:
26140	000462	006474	000100	000416	006475	061000	006473	066000	.2.<.@...=b...;1
26150	021401	101014	000404	006466	060100	000422	006463	060300	#.....6'@...3`a
26160	000417	031002	143000	031407	041000	045002	021401	024453	..2.F.3.B.J.#.)+
26170	101015	024452	045001	141000	031403	006444	061100	021402	..)*J.B.3..\$b@#.
26200	035775	041412	102520	041413	165000	006437	000002	006666	;.C..PC.j.....6
26210	000417	011415	011405	021402	024417	123000	041402	015406	#.)&.C...
26220	000714	000406	025775	006422	024145	006417	020000	021415	.L..+...(e...#.
26230	031775	041003	000624	000400	001400	024345	174000	024241	3.B.....(ex.(
26240	000004	024357	000500	000100	024406	024267	054320	006315	..(o.@.@).(7XP.M
26250	000000	125300	123000	025002	123000	025014	034410	136432	..*@&.*.&.*.9.=.
26260	126401	024406	123000	006405	061100	002316	000053	040000	-.)&...b@.N.+@.
26270	024357	006533	021407	025775	006531	002531	020531	126400	(o.[#+...Y.Y!Y-
26300	004746	025775	006537	002523	035775	021404	034041	024521	.f+...S;.#.8!)Q
26310	123415	000765	024517	123414	000762	021401	101015	000414	'..u)O'..r#.....
26320	035775	021404	034041	024507	123415	000406	025775	006504	;.#.8!)G'...+..D
26330	020000	006503	023663	030505	025410	124405	000406	102400	..C'31E+.).....
26340	041000	151400	125404	000775	025406	124400	102000	041000	B.S.+...+.)...B.
26350	151400	125404	000775	035403	025405	034041	021406	106400	S.+...;+.8!#...
26360	021410	106400	124405	000406	102400	041000	151400	125404	#...).B.S.+.
26370	000775	031403	020443	126400	004652	025775	006443	002427	..3.!#-...*+...#.
26400	035775	021406	024434	107400	122700	125220	125220	034430	;.#.)...%@*.*.9.
26410	116437	000537	035014	116414	000533	034041	021005	122437	..._:....[8! "%.
26420	000532	021406	041415	000420	024241	026626	026056	000000	.Z#.C...(!-...:
26430	020000	100000	001000	024406	024275	000010	000377	000115	). (=.....M
26440	026616	027062	025412	125400	035005	136415	126400	034041	-..2+.+.:.=-.8!
26450	045412	030767	133000	021000	031403	100014	000460	021410	K.1w6." .3....0#.
26460	106700	021402	123000	006520	062000	035775	041412	102520	.@#.&..Pd.;.C..P
26470	041413	034041	025401	020511	125015	020510	025412	006507	C.8!+.!I*!H+..G
26500	025775	006506	000002	006736	000455	031775	021004	024501	+..F...^.-3..."A
26510	123414	000443	021412	030725	113000	102520	041000	015415	'..##.1U...PB...
26520	000405	021406	031775	041003	002465	031403	021412	101400	..#.3.B..53.#...
26530	035005	116415	102400	034041	041412	000705	020454	126400	:.....8!C..E!,-.
26540	006446	025775	006451	000002	006675	000414	000674	041014	.&+...)=...<B.
26550	006444	023466	006442	023503	025775	006440	023752	006430	.\$'6." 'C+... 'j..
26560	010000	031775	102400	041003	025410	030653	133000	021000	..3...B.+1+6..."
26570	103057	002420	031775	011003	031403	125400	035005	136415	./...3...3.+...=.
26600	126400	034041	000763	024357	000040	000020	026246	024406	-.8!s(o...,&).
26610	100000	026056	000010	024407	024276	024267	000000	000000	...,...).(>(7...
26620	000000	000000	000000	000000	000000	000000	054320	006315	XP.M
26630	000000	021014	025774	122415	000427	122432	126001	126520	...+.%.%...-P
26640	123000	041014	020423	125112	020422	126400	006421	025775	&.B.!.*J!.-...+
26650	006420	002316	035775	021404	034041	024414	123415	000752	...N;.#.8!)."'.j
26660	102400	041014	000747	011400	002316	000002	000001	026246	..B..g...N.....&
26670	027062	040000	054320	006315	000000	006546	006546	006546	2@.XP.M...f.f.f
26700	000120	002545	006543	000200	000440	102620	041014	021002	P CORPORATION
26710	006535	001400	000402	000406	024533	123000	006532	061100	.].....)f&..zh@

26730	061300	000405	024520	123000	006514	061300	025775	004523	b@...)	P&...Lb@+...S
26740	002506	102000	041014	002503	102400	025775	006505	002477	.F...B...C...+...E.?	
26750	035775	021404	034041	024501	123414	002471	102520	041014	;.#.8!)A'.9.PB.	
26760	000764	054320	006315	000000	035775	102400	041402	006456	.tXP.M...;...C...	
26770	000040	000402	000407	020462	025002	123000	006452	061000	!2*.&.*b.	
27000	000425	006444	040013	000402	000412	006443	062400	024447	...\$@.....#e.)	
27010	123400	025002	123000	006435	063000	000410	006427	000200	'*.&...f.....	
27020	000402	000404	021002	006425	061000	025775	006431	006432	"....b.+.....	
27030	030342	063077	006413	000100	000402	000404	020422	031775	0bf?...@.....!3.	
27040	041002	011400	002316	024313	024241	024345	026056	007000	B....N(K(!e,...	
27050	024357	003400	000200	026626	040000	002600	037777	027277	(o.....-@...?..?	
27060	000100	027425	054320	006315	000000	035775	102400	041403	.@/.XP.M...;...C...	
27070	004427	000413	006571	004536	006765	030342	063077	006762	y..~u0bf?.r	
27100	030470	002316	011400	002316	102620	041014	004571	004522	18.N...N..B..y.R	
27110	006751	030342	063077	006746	031277	002316	063077	054320	.i0bf?.f2?.Nf?XP	
27120	006315	000004	021000	006541	006540	020540	106415	000406	.M... ..a..!'.	
27130	020536	106415	000403	020534	106415	126521	126400	045404	!^.....!\...-Q-.K.	
27140	006530	001400	000417	021003	024525	100405	000404	100000	.X.....)U.....	
27150	125220	000774	021014	103254	024516	006513	000040	125220	*.....,)N.K.*.	
27160	045401	020512	041403	102520	041402	011400	021404	101014	K.!JC..PC...#...	
27170	000427	006477	040053	000402	000412	006477	060400	006471	...?@+.....?a...9	
27200	001400	002316	025401	123414	002316	000404	006466	063700	...N+..'..N...6ge	
27210	002316	015403	000754	015402	000752	015400	002316	006455	.N...l...j...N.-	
27220	063500	000402	000753	015403	000773	015402	000771	015400	g@...k.....y..	
27230	002316	054320	006315	000000	006434	001400	000402	000404	.NXP.M.....	
27240	006434	060300	002316	006425	040053	000404	006426	060200	..`@.N..@+.....`.	
27250	002316	020424	025002	107000	020422	006413	000040	123000	.N!*...!.....&.	
27260	006414	061200	002316	027277	025012	000110	000105	000121	..b..N.?*.H.E.Q	
27270	024345	040000	100000	135600	024357	002600	174000	054320	(e@...;.(o..x.XP	
27300	006315	000000	006514	000100	000456	006512	062400	006510	.M...L.@...Je..H	
27310	065400	035775	041406	045405	006503	060400	006500	000040	k.;.C.K..Ca..@.	
27320	000402	000410	024476	035002	167000	006472	065000	006470	)>:..n...:j..B	
27330	064400	035775	041404	045407	006462	000040	000402	002316	i.;.C.K..2. ....N	
27340	020461	025002	123000	006454	061000	006452	060400	006450	!1*.&...b..*a..(	
27350	065400	035775	041410	045411	020446	025002	123000	006440	k.;.C.K.!&*.&...	
27360	061000	002316	035775	021407	041404	006432	066400	020434	b..N;.#.C...m.!.	
27370	006427	063000	006425	060400	035775	045406	041407	041405	..f...a.;.K.C.C.	
27400	020424	006416	063000	006414	060400	006412	065400	035775	!...f...a...k.;.	
27410	041410	045411	102400	006404	063000	002316	024345	024357	C.K.....f..N(e(o	
27420	002200	002400	002600	000001	000002	054320	006315	000012	XP.M..	
27430	031775	021004	025005	041404	045405	031400	021000	011400	3..*..C.K.3."...	
27440	041401	023401	011401	024424	107400	122700	031401	147000	C.'...)%@3.N.	
27450	045410	027401	045403	101223	126621	025402	101220	127003	K./..K...-+.....	
27460	000404	030407	113000	003000	021410	041401	000753	000377	..1.....#.C..k.	
27470	030050	031776	021006	025403	123404	102620	041402	000765	0(3..+..'..C...u	
27500	031775	021002	025403	124000	123400	122000	041002	000755	3..+.(.'\$.B..m	
27510	031775	021002	025403	124000	123400	041002	000746	031775	3..+.(.'B..f3.	
27520	021002	000752	023403	011403	027403	011403	152400	100015	..j'.../...U...	
27530	000423	030442	113405	000412	030440	113404	000406	030434	..1.....1.....1.	
27540	142400	033403	011403	000402	152400	035776	035406	163400	E.7.....U.;.j.g.	
27550	034041	101015	000750	021404	123400	041406	101004	102620	8!...h#..'C.....	
27560	025405	147404	102620	045407	041402	000677	021406	041404	+..O...K.C..?#.C.	
27570	021407	041405	000672	100000	040000	031775	021013	041003	#.C.....@.3..B.	
27600	021007	101100	101220	041412	000660	031775	021013	031776	"..@..C..03..3.	
27610	006550	025642	031775	106414	000406	021412	025012	122400	.h+"3.....#.*.%	
27620	024541	122421	101040	021006	031776	006533	025652	031775	)a%... "3..[+*3.	
27630	123405	101013	122000	025013	123000	031776	006524	000400	'...\$.*.&3..T..	
27640	102520	031775	041003	101112	000402	002516	102400	041003	.P3.B..J...N..B.	
27650	006514	024020	031775	021003	100404	100000	041003	002504	.L(.3.. ....B..D	
27660	031775	021003	025013	122414	000762	002476	031775	021003	3..*.%..r.>3..	
27670	101300	025012	123000	041411	002467	025411	021412	106437	.@*.&C..7+.#...	
27700	002463	031775	102400	041003	006460	023752	025411	021412	.33...B..0'j+.#.	
27710	106432	002452	025775	006452	010000	006447	023765	031775	..*+...*... 'u3.	
27720	126620	045014	025002	006437	000040	000423	006434	001775	ATA CORPORATION	
27730	000402	000411	020434	006427	000400	000402	123000	006430	!.....&...	

27750	034421	167000	006415	065300	006416	000401	006415	002404	9.n...j@.....
27760	024324	001000	024345	027464	024275	024407	007000	024357	(T..(e/4(=)...(o
27770	003400	000200	027117	027231	031775	021411	025412	122414	0..3.#.+.%.
30000	000646	024413	122400	025012	106436	000641	004471	000403	..&).%.*.....!9.
30010	006405	023341	006403	023355	000400	024275	023403	011403	..&a...&m..(='...
30020	011403	100015	002453	025404	031405	101223	000403	025405	++3.....+
30030	031404	151014	000764	101015	102620	106414	000760	015403	3.R..t.....p.
30040	035403	002435	035401	002433	011400	002316	021401	041410	;...;.....N#.C
30050	002425	027471	027500	027510	027517	027522	027566	027575	..9/Q/H/O/R/v/
30060	027605	027652	027660	027666	027675	027706	027717	027774	./.*0/6/=F/O/
30070	030016	030042	030044	030046	030051	027464	024275	054320	0.0"0\$0&0)/4(=XP
30100	006315	000005	025011	121000	034570	163400	174000	167400	.M...*.9xg.x.o
30110	034041	041402	021010	030562	051401	030561	143415	000410	8!C...1rS.1qG...
30120	030557	125120	101102	147000	015401	000770	000545	035401	1o*P.BN....x.e;
30130	030545	172400	034041	051403	030544	101220	125200	151404	1eu.8!S.1d...*.S
30140	000775	021402	045402	024536	101120	125404	000776	030525	..#.K.)~.P+...1U
30150	051401	025402	122415	000413	101123	000406	024524	111000	S.+.%....S..)T.
30160	133520	123000	142400	015401	000765	000506	031401	020505	7P&.E....u.F3.!E
30170	142400	041404	025403	122432	000413	106400	030505	102400	E.C.+.%.....1E.
30200	006511	030474	006510	030471	105000	021404	000413	122400	.I1<.H19..#...%
30210	105000	102400	030472	006476	030460	006475	105000	030456	1:..>10.=..1
30220	021403	006470	031402	151015	000447	151112	000404	151120	#...83.R...RJ..RP
30230	125400	000774	051402	030452	146423	000436	030450	006453	+...S.1*M...1(+
30240	045405	111000	021402	126400	150405	000405	101220	125200	K...#.-.Q.....*
30250	151404	000775	041403	045404	021405	125015	105001	105400	S...C.K.#.*.....
30260	030427	132432	000431	112433	000404	126400	045404	000424	1.5.....-K...
30270	030420	132432	000445	002316	003777	000025	177700	004000	1.5..%.N.....@.
30300	177772	177773	000240	000023	000303	107714	000020	000377	C.L...
30310	000401	031331	031310	031774	021405	113000	025403	021000	..2Y2H3.#...+.
30320	115000	137520	123000	162400	041000	034041	025404	125015	..?P&.e.B.8!+.*
30330	000407	021001	115000	137520	123000	162400	041001	034041	..?...?P&.e.B.8!
30340	011400	002316	006001	001700	004001	004000	002001	000040	...N...@.....
30350	004401	001000	002001	000140	004401	002000	012001	030415	1.
30360	004401	000400	002001	000100	046404	012001	030430	005401	@M...1..
30370	000400	012001	030432	004401	000200	012001	030445	004401	1.....1%..
30400	000100	002001	000020	004401	000100	002001	001200	046404	..@.....@....M.
30410	012001	030464	005401	000100	044000	100040	100004	160054	..14...@H...^
30420	000100	000100	000400	000302	001000	000102	177777	000000	..@.@...B...B...
30430	177777	010000	100040	000000	001000	000200	001000	000400	.....
30440	100000	001000	100000	177777	000000	100040	000000	010000	.....
30450	000020	000000	000100	000040	000200	000000	000400	000000	@.
30460	001000	000000	177777	000100	001000	000100	177777	100000	@...@...
30470	006001	030000	012001	031001	042401	023574	002001	000100	..0...2.E.'.....@
30500	046404	012001	030430	043401	023574	012001	030713	014000	M...1.G.'...1K.
30510	012001	031006	034400	012001	031021	004401	020000	012001	..2.9...2....
30520	031040	005401	010000	012001	030762	042401	023621	010001	2.....1rE.'...
30530	000002	046411	016000	026000	002001	040053	020400	010001	..M....,....@+!...
30540	000001	033400	026000	012001	030737	047406	010001	000002	..7.,...1_0....
30550	046402	024000	030000	044000	022000	012001	030747	014000	M.(.0.H.\$...1g.
30560	002001	000002	046404	010001	000001	040401	031106	002001	M.....A.2F.
30570	000040	046412	010001	000001	046407	010001	000200	046404	.M.....M.....M.
30600	012001	031057	042401	023663	002001	001400	046404	010001	..2/E.'3....M...
30610	000001	040401	031101	002001	000010	040401	031111	002001	..A.2A....A.2I..
30620	000001	046410	002001	040000	040401	031114	002001	040000	@.A.2L..@.
30630	041401	031123	012001	031064	046411	012001	031072	047406	C.2S..24M...2:0.
30640	010001	000002	046403	010001	000001	037400	002001	000200	M.....?....
30650	046404	012001	030713	043401	023752	002001	040013	040401	M...1KG.'j..@.A.
30660	031132	002001	000040	040401	031141	002001	000020	040401	2Z...A.2a....A.
30670	031176	002001	000100	040401	031207	002001	000200	040401	2....@A.2....A.
30700	031226	002001	000400	040401	031237	002001	001000	040401	2....A.2....A.
30710	031256	042001	023321	040000	000677	100001	001677	100000	2.D.&Q@..?..?..
30720	100040	001777	000376	000020	000037	000100	100736	000200	@.~.
30730	000077	000400	100377	001000	100177	177777	000077	000000	?.....?..@.
30740	100000	000400	100377	001000	100177	177777	000001	000000	C.....
30750	077777	000400	100377	001000	100177	141773	177776	177777	C.....

30770 000000 000200 000040 000400 000000 001000 000000 177777
31000 000020 100040 100000 160000 177777 000000 000320 000000 ...P.
31010 100040 176165 177477 000400 177771 001000 177751 177777 .u?...y...i.
31020 177751 100040 000400 000300 000020 000004 000100 000000 .i....@....@.
31030 000200 000040 000400 000000 001000 000000 177777 000020 ...
31040 100040 100404 160356 000020 000024 000100 000100 000200 ...n....@.@.
31050 000040 000400 000202 001000 000002 177777 000020 100040
31060 000000 000100 177777 000000 000040 000200 000100 000004 ...@....@.
31070 177777 000000 100040 177577 177777 000100 177773 177777@....
31100 177777 000000 023663 000000 023663 177777 000400 023710'3..'3...H
31110 177777 000020 023524 177777 000400 023544 000020 023456T...'d..
31120 001000 023402 177777 000020 023544 000400 023456 000001 ...'d..
31130 023402 177777 000100 023447 000010 023330 000004 023421 ...@'...&X..
31140 177777 002000 023411 000400 023355 000200 023402 000100 ...&m...@.
31150 023466 000040 023503 000020 023372 000010 023562 000004 '6..'C...&...r..
31160 023421 000201 023634 000041 023544 000101 024062 000021 ...!'d.A(2..
31170 024075 000011 024107 000005 024053 177777 000004 023330 (=...(G...(+'...&X
31200 000010 023653 000020 023421 000040 023740 177777 001000 ...+'...
31210 023411 000400 023432 000200 023562 000040 023544 000020 ...r..'d..
31220 023421 000010 023355 000004 023372 177777 000040 023503 ...&m...&...C
31230 000020 023330 000010 023421 000004 024053 177777 000000 ...&X...'(+..
31240 023663 000400 023544 000200 023544 000100 023447 000010 '3..'d..'d.@..
31250 023330 000004 023562 000002 023402 177777 000000 023663 &X...'r...'3
31260 000200 023544 000100 023447 000040 023421 000020 023456 ...'d.@'...
31270 000010 023330 000004 023562 000002 023402 177777 002001 ...&X...'r'...
31300 000020 006401 000100 004001 000400 042001 023554 102400@....D..'l..
31310 010040 056040 142432 000412 034430 125120 101100 142412 .\E...9.*P.@E.
31320 142400 125100 175404 000773 175021 175040 034041 002317 E.*@.....8!..
31330 102460 010040 056040 034411 125203 101201 143220 175404 .0.\9.*...F..
31340 000774 125260 034041 002317 177760 000000 054777 034040 ...*08!.0.p..Y.8
31350 051403 030320 153200 051405 030425 156400 041774 045775 S.0PV.S.1.]..C.K.
31360 020041 041777 054041 022762 010761 163000 030042 112433 !C.X!%r.qf.0".
31370 000407 040040 021400 101100 021774 031776 002747 054040 ..@#...@#..3..gX
31400 002043 177773 030041 020776 143000 040040 035377 054041 ..#..0!!..F.@...X!
31410 021000 105100 125220 044320 101100 021374 025375 031376 ...@*..HP.@...*.2.
31420 002320 054724 036040 014040 175100 175220 054320 034716 .PYT<...@...XP9N
31430 002320 031452 031462 031472 031502 031512 031522 031532 .P3*323:3B3J3R3Z
31440 031542 031562 031552 031572 031602 031612 031622 031632 3b3r3j3.3.3.3.
31450 031642 031652 000002 157771 000000 000000 000000 017772 3"3*..._y.....
31460 000013 000000 000002 166311 000002 000014 000000 011402lI.....
31470 000045 000000 000002 150053 000012 000006 000000 027616 .%....P+...../
31500 000065 000000 000002 040501 000024 000014 000000 137112 .5....AA.....>J
31510 000123 000000 000002 114601 000002 000014 000000 023072 .S.....&:
31520 000065 040000 000002 176614 000001 000010 000000 001142 .5@.....b
31530 000005 000002 000002 140755 000023 000027 000002 136621Am.....=
31540 000123 100001 000002 121554 000023 000030 000002 156022 .S....#1.....\
31550 000123 100000 000002 151711 000023 000030 000005 125662 .S....SI.....+2
31560 000123 100000 000002 000613 000005 000030 000001 077002 .S.....
31570 000123 100000 000002 173737 000000 000000 000000 003772 .S....w_.....
31600 000045 000000 000002 167737 000000 000000 000000 007772 .%....o_.....
31610 000045 000000 000002 171426 000002 000030 000000 046172 .%....s.....L
31620 000123 140001 000002 117652 000004 000040 000000 057772 .S@....*....._
31630 000065 000001 000002 173112 000002 000020 000000 004632 .5....vJ.....
31640 000005 000003 000002 035060 000023 000043 000010 042421:0...#...E
31650 000177 100000 000002 037646 000010 000040 000000 137772?&.....?
31660 000065 000001 056010 022546 124000 107400 020535 143000 .5..\.%f(...!F
31670 006003 176400 056476 034537 172033 151112 000515 006525]>9_t.RJ.M.J
31700 125300 021776 030531 112414 000451 125113 000507 020014 *Q#.1Y...)K.G
31710 006514 101400 131300 006511 147000 044512 101400 006505 .L..2@.IN.IJ...E
31720 101400 131300 006502 147000 044504 030507 020507 041403 ..2@.BN.ID1G!GC
31730 023403 024476 011403 101005 000463 106414 000405 023403 '.)>.....3.....
31740 024470 106405 000404 011403 151400 000763 145000 021775)8.....S..sJ.#.
31750 042420 006454 004532 004550 002004 125112 000443 131777 ...Z.h...*J.#2@
31760 021776 024455 106404 002004 024453 021775 006437 002004 M. CORPORATION
31770 000431 056010 006003 020430 024436 045403 030441 006425 ..\....!..).K.1!..

32010 122400 042432 002004 102400 002412 020423 002410 020422 %E.....!...!
32020 002406 020421 002404 064110 034213 034173 032442 000000 ..!...hH8.8.5..
32030 000000 000437 000076 014000 000000 032171 014400 000200>....4y...
32040 000021 000012 000015 000434 000000 000000 000000 000000
32050 000000 000000 000000 000000 000000 000000 000000 000000

32100 000000 000000 000000 000000 054006 034412 165120 172432X.9.jPu..
32110 132432 010006 034010 002006 000004 000011 000060 000020 5...8.....0..
32120 000430 000014 000040 056010 006003 020014 024766 123000 \...)v&..
32130 006674 004427 045403 101400 006670 020765 034763 136414 <..K....8!u9s=..
32140 166015 000414 106414 125005 000411 004413 021403 115120 1.....*.....#...P..
32150 175120 163120 123000 042745 002004 034010 021403 000774 .PfP&.Ee...8.#...
32160 056010 006003 020734 106400 020731 106032 000631 045776 \...!\...!Y....K..
32170 002004 052504 030060 052504 030061 052504 030062 052504 ..UD00UD01UD02UD..
32200 030063 052504 030064 052124 044461 022120 046124 052124 03UD04TTI1\$PLTTT..
32210 047461 022124 052120 022103 042122 022124 052117 022124 01\$TTP\$CDR\$TTO\$T..
32220 052111 022114 050124 022120 052122 022120 052120 022124 TI\$LPT\$PTR\$PTP\$T..
32230 052122 046524 030072 046524 030472 046524 031072 046524 TRMT0:MT1:MT2:MT..
32240 031472 046524 032072 046524 032472 046524 033072 046524 3:MT4:MT5:MT6:MT..
32250 033472 041524 030072 041524 030472 041524 031072 041524 7:CT0:CT1:CT2:CT..
32260 031472 041524 032072 041524 032472 041524 033072 041524 3:CT4:CT5:CT6:CT..
32270 033472 000000 047503 054520 044522 044107 020124 041450 7:...OCYPIRHG TC(
32300 020051 043504 026103 034461 030467 030454 033471 026062)GD,C91171,79,2..
32310 034461 031467 046101 020114 044522 044107 051524 051040 9137LA LIRHGSTR..
32320 051505 051105 042526 000104 040014 044015 165000 034012 SEREEV.DG.H.j.8..
32330 051434 045435 125400 044472 101100 041436 027435 045437 S.K.+..I:..@C./..K..
32340 024466 044010 021437 024464 123400 122414 000507 021437)6H.#.)4'.%..G#..
32350 024460 123400 122414 111000 020455 101414 006453 034012)0'.%...!-...+8..
32360 051433 024451 151113 132032 000453 024446 133000 031000 S.))RK4..+)&6.2..
32370 151415 000460 024442 021437 123405 000407 122415 000570 S..0)"#.'.%...x..
32400 101300 024434 123414 101220 035006 117000 020570 035400 .@).'.%...!x;..
32410 175415 000431 005400 000430 010411 034012 021436 1012008.#...
32420 020014 024015 031434 034016 002401 000000 034420 014000 .(.3.8.....9...
32430 000077 031662 000037 032607 003400 000004 177700 020547 .?32..5.....@!g..
32440 101404 000522 042543 034012 126000 021431 101004 006535 ...REc8.,.#.....|..
32450 000745 020523 000770 020522 000766 025437 020521 004435 .e!S.x!R.v+.!Q..
32460 000667 020517 004432 000422 020515 004427 000417 030434 .7!0....!M....1..
32470 034513 021000 106415 000406 101005 000756 151400 151400 9K".....nS.S..
32500 000771 021001 101415 000750 003001 020723 025437 123400 .y"....h...!S+..
32510 024472 107000 045437 000634 054006 034721 137400 116414):..K...X.9Q?...
32520 010006 034012 002006 032524 007400 034647 010000 035205 ..8...5T..9'...:..
32530 001400 034226 011000 034233 005000 034264 021000 033715 ..8...8...84...7M..
32540 021022 034330 021007 033416 021010 033434 021052 031771 ..8X"....7'..7'..*3y..
32550 021004 177777 021003 177777 010400 177777 021005 177777 "...."....."..
32560 021006 177777 000000 132000 022422 113000 000601 021022 "....4.%....."..
32570 025002 040014 044015 000621 000012 000002 000003 013400 *.@.H....."..
32600 024400 011400 014000 032414 034173 000434 177777 177777).....5.8....."..
32610 177777 177777 177777 177777 177777 177777 177777 035046:S..
32620 177777 035046 034727 177777 177777 177777 034674 177777 ..:&9W.....9<..
32630 177777 177777 177777 177777 177777 177777 177777 177777
32640 177777 177777 177777 177777 177777 177777 177777 000014
32650 010000 126401 025023 056010 006003 011774 125004 000461 ..-.*.\.....*..L..
32660 020507 123405 000412 020511 004526 021775 004524 020506 !G'...!I.V#...T!F..
32670 004522 020014 006477 040014 125005 000410 006474 020751 .R...?@.*....<!i..
32700 025002 123405 000403 024744 006456 020461 025002 107415 *.')d...!1*...
32710 000412 020457 034461 107405 177120 160400 126400 006443 ..!/91...Pa.-..#..
32720 101404 000776 025776 125004 002004 024440 021023 107404 ..+.*...) "..
32730 000405 021011 101212 000776 045020 007010 006434 002004 ".....J.....
32740 021011 101212 000776 007010 020417 025022 123404 102401 ".....!.*'..
32750 020015 100000 024412 123400 124000 123000 025023 107400).'.(&.*...
32760 045002 000677 033646 040000 173777 000044 000001 000004 J..?7&@.w..\$.
32770 000020 034647 033703 000144 065774 066002 046117 040504 ..9'7C.dk.l.LOAD..
33000 020000 026040 051524 051111 045505 020101 047131 020000 ., STRIKE ANY K..
33010 042531 006400 056010 006003 051403 030415 006556 101000 BY CORROBATION..
33020 125004 000403 031403 002004 006547 034537 166404 000767 *...3....g9_m..w

33040 045403 006531 000476 045776 034514 020514 167400 136414 K.Y.>K.9L!Lo.=.

33050 000411 006503 015775 006501 015403 000764 020014 041775 ...C...A...t .0.

33060 000757 006473 000463 020477 106415 000754 021775 006502 .o.;.3!?....l#..B

33070 025776 020472 006462 000421 025402 125005 000426 020465 +.!:..2..+.*...!5

33100 034465 106414 166415 000421 034010 011403 021403 024457 95..m...8...#.)/

33110 106423 000420 011775 000726 125320 120400 100000 107464V*P!....4

33120 000775 127012 000414 000751 034010 011774 021403 040015i8...#.0.

33130 002004 021775 126400 006436 030421 000406 030420 000404 ..#.-...1...1...

33140 030417 015403 000401 052433 000762 020422 106415 000771 1.....U..r!.....y

33150 020420 122404 000711 000703 034245 000022 000024 000006 !.%..I.C8%.....

33160 000177 000040 000012 000400 000015 000014 000204 000032

33170 000134 034173 033577 033646 034213 033373 000434 056010 .\8.7.7&8.6...\
33200 004574 020014 006003 025020 045403 006767 020752 107400*..K..w!j..

33210 045776 121320 134400 174000 167464 000775 103200 105300 K."P9.x.o4.....3

33220 034010 020535 122404 000404 020535 006727 000475 006744 8.!]%....!].W.=..d

33230 011403 025776 020733 122404 000433 041403 020525 024725 ..+.![%...C.!U)U

33240 006714 000745 020522 006711 126401 000405 020521 006724 .L.e!R.I-...!Q.T

33250 101404 000776 020014 025775 106400 125400 011774 044015+...+...H.

33260 021002 024510 107404 126401 025403 045020 002004 020675 .)H..-+.J...!=

33270 122404 000407 041403 020472 024666 006657 006675 000753 %...C.!:.)6./.=.k

33300 125005 000751 020454 122404 000405 020455 024460 006645 *.i!,%...!-)0.%

33310 006663 021403 024654 106433 000417 024455 106033 000423 .3#.),....)-...
33320 011775 021775 000663 024434 006647 011403 021403 024431 ..#..3)...'.#.)

33330 107414 000772 000757 040015 126400 045020 006635 020616o@.-.J...!

33340 042636 002004 021002 024425 107405 000753 011775 021775 E....).k..#.

33350 006624 011403 020612 122415 000632 000734 000011 000240!.%....\
33360 000007 000002 000200 000020 000100 001000 000377 177760@.....p

33370 040000 100000 000120 102401 102520 054006 026417 034415 @....P...PX.-.9.

33400 167404 126000 036010 123015 002006 020405 125004 020404 o.,.<.&...!.*.!

33410 002401 032442 000007 000010 002000 000437 056010 006003 ..5'.....\
33420 004426 000447 004432 000456 030015 025000 122414 000441 ...'.0.*.%..!

33430 126000 045003 051403 002004 056010 006003 004410 000431 ,,J.S...\
33440 004414 000402 002004 025003 045403 002004 024435 020014*..K...).

33450 101113 106433 001400 001401 054006 034013 031403 025000 .K.....X.8.3.*

33460 151415 000405 122415 000404 155000 000771 010006 002006 S...%...Z..y....

33470 122015 000403 020412 002405 020015 042402 002004 034263 \$.!... .E...83

33500 032442 020404 002776 000076 000036 000045 056010 004665 5"!.....>...%\..5

33510 024015 020014 124405 001401 006003 006407 004530 101400 (. .).....X..

33520 011776 000774 011774 002004 034213 056010 004645 0204438.\..%!#

33530 024015 006442 125203 124401 000433 020014 125005 001401 (. ."*)....*..

33540 006003 004436 000416 020427 006427 125301 000404 021401!...*A..#.

33550 006426 125300 021401 006423 011776 000764 011774 002004 ..*@#.....t...

33560 030411 021776 024015 107000 044015 052407 002004 030406 1.#.(...H.U...1.

33570 000775 000006 004000 034245 000434 000003 034173 0560108%....8.\

33600 006003 020442 025020 045403 006441 000420 025021 021017 ..!"*..K..!..*..

33610 122453 000414 021011 101213 000417 021017 101004 000406 %+.. ..

33620 034010 011403 000764 004460 002004 006417 000402 000410 8....t.0.....

33630 011774 045776 002004 007007 011011 000751 002004 020404 ..K.....i..!

33640 006405 000764 000744 000040 034003 034245 056010 006003 ..t.d. 8.8%\..

33650 020431 006774 000423 060277 021011 101212 000405 007007 !.....?'.....

33660 011011 060177 002004 004441 000403 000774 000772 060177 ..\.....!.....\

33670 020404 101404 000777 000760 177600 004427 000777 000762 !.....p.....r

33700 007007 100000 000757 054006 007010 176400 055017 055011oX.....Z.Z.

33710 035013 055016 055015 034010 002006 030406 151415 102401 ..Z.Z.8...1.S...

33720 021002 040014 001400 177777 054006 021012 035017 116415 .@.....X.

33730 002006 010006 162014 000406 010006 035011 175200 175120d.....:....P

33740 055011 035015 021014 116415 035013 055015 020500 035002 Z.:.Z.!@:..

33750 163405 000406 035015 045400 011017 011015 002006 035015 g....:K.....:

33760 175220 020421 035400 125003 175300 117403 167301 167000 ..!.;.*..@..nAn.

33770 035015 175220 045400 011017 011015 125003 125300 101300 :...K.....*.*@.

34000 107400 002006 177400 054006 021017 101004 000410 010006X.

34010 021011 101200 101120 041011 034010 002006 025016 035014PB.8...*..:

34020 166415 025013 045016 020423 035002 117405 000404 135000 ..*..J.!.....:

34030 025400 000410 135220 020747 101300 025400 125003 125000 ..L CORPORATION*@

34040 107400 015017 000401 011016 034010 002006 004000 0565028.....]B

34050	040011	041424	043423	051428	020007	041430	020007	101100	8.C.A.S.C.C.
34060	101100	041432	020000	101005	063077	041430	020776	040000	@C. ...f?C.I.@.
34070	022461	041427	063677	000407	020531	040000	020565	101415	%1C.g?...!Y@.lu.
34100	063077	002562	061477	030013	025000	106415	000411	031003	f?.rc?0.*.....2.
34110	150014	000773	024436	107000	044401	000000	000413	021001	P....)....I.....
34120	040007	024011	045005	050011	062177	003004	060277	035005	@.(.J.P.d...'?;
34130	054011	025432	125220	125200	044007	066077	021431	040006	X.+.*.*.H.1?#.Q.
34140	021430	040005	021424	025425	031426	035427	060177	002005	#.@.#.+3.;. ...
34150	060200	000432	054006	034010	041401	020406	117000	054010	`...X.8.C.!...X.
34160	021775	045776	002006	000004	034010	020776	116400	054010	#.K.....8.!...X.
34170	021401	025402	003400	056010	006003	051403	011775	030426	#.+... \...S...1.
34200	147400	115222	151300	021400	143403	125300	107000	045400	0...RQ#.G.*@..K.
34210	034010	031403	002004	054006	115220	020410	025400	101013	8.3...X...!+. ...
34220	125300	107400	161100	034010	002006	000377	022425	024433	*@..b@8.....%.)
34230	044014	040015	001400	020014	026417	107000	030424	020415	H.@... -...1.!
34240	132433	002420	046411	044015	001400	054006	035002	117405	5...M.H...X....
34250	010006	034010	002006	000404	000026	032431	177702	032044	..8.....5..B45
34260	033703	032442	000000	177777	056010	006003	022767	101415	7C5".... \...%w.
34270	000427	020765	041403	020764	101120	041777	021777	004714	..luC.!t.PC.#...L
34300	131300	151112	000412	030405	133000	031000	035006	007401	2@RJ..1.6.2.:...
34310	032607	021777	126000	004660	011777	011403	000760	030013	5.#...0.....p0.
34320	021011	101202	000776	006735	031003	151414	000772	002004	".....]2.S.....
34330	062677	000467	030462	034462	157000	175112	000407	021400	e?.71292~.J..#.
34340	055400	025400	041400	136415	000770	102000	175113	163001	[.+C.=..x...Kf.
34350	160000	034012	024444	122400	031403	025407	146433	112032	`8.)\$%.3.+..M..
34360	111000	050701	045404	030013	050011	006673	031003	151414	..QAK.0.P...;2.S.
34370	000775	034666	102400	175415	000406	020422	051400	175400	..96.....!S...
34400	101404	000775	040007	040406	032407	151414	007007	062177	@.A.5.S...d.
34410	002402	000000	032414	033723	004000	014000	000400	177740	5.7S.....
34420	022450	101415	042432	030435	024431	125414	131000	037000	%(..E.1.).+.2.>
34430	151400	174015	000775	054013	025000	125005	000410	027000	S.x...X.*.*.....
34440	151400	124015	000772	045403	135000	000767	126000	045403	S.(...K.:..w.,K.
34450	020402	040660	000401	000656	032617	177777	177777	177777	!A0....5.....
34460	034461	033723	032607	032610	032624	032620	034456	034457	917S5.5.5.5.9.9/
34470	032626	032622	032614	032625	032623	032615	032621	032616	5.5.5.5.5.5.5.5.
34500	032611	032612	032613	000000	006017	021022	000401	034012	5.5.5.....8.
34510	035405	174015	063077	001400	022557	064610	101005	000405	;.x.f?..%oi....
34520	006512	000400	060110	002455	020507	107405	000405	034517	.J..`H.-!G....90
34530	125234	166415	000457	030507	021011	101300	101113	000437	*.m../1G".@.K.
34540	006472	000440	000401	021011	101113	000431	030475	020464	:.:..".K..1=!4
34550	106415	024463	021011	101212	000430	065111	011011	020456	..)3".....jI..!
34560	122404	000405	024454	006447	000412	000401	020450	122404	%...),..'.!(%.
34570	000406	041020	024445	006437	000402	000401	030474	002401	..B.)%.....1<.
34600	034126	024437	065111	000773	011020	006425	000770	000750	8V).jI.....x.h
34610	000747	036430	121224	036432	175414	175005	000760	054412	.g=. . =.pY.
34620	060277	063511	000777	006017	021022	000401	101004	062677	`?gI.....e?
34630	002401	000000	033724	000177	000137	000134	000015	000012	7T.... \...
34640	000007	000411	034727	035046	035141	000412	000003	056010	9W;:&a.... \
34650	006003	051403	030420	021011	101212	000776	042415	030763	..S.1. ....E.1s
34660	024404	021011	045011	006406	000200	041011	044014	031403	).".J.....B.H.3.
34670	002004	033577	034674	034411	000010	000017	000000	000000	..7.9<9.....
34700	034514	000000	034757	034773	035025	000000	000017	071167	9L..9o9.:.....rw
34710	071206	000000	000000	000000	132400	000003	000003	000404	r.....5.....
34720	000000	000000	000000	000000	000000	000000	000000	177777	.....
34730	000003	000040	000000	000000	000000	034753	034774	035025	9k9.:.
34740	000000	000017	071150	071167	000000	000000	000000	000000	rhrw.....
34750	000000	040003	000040	032652	035021	035016	035001	034763	..@.. 5*:.:..9s
34760	035027	034765	034770	020412	002767	102520	042705	002453	:.9u9x!..w.PEE.+
34770	102520	042702	002452	060110	001400	071774	022124	052122	.PEB.*`H..s.\$TTR
35000	000000	020442	024442	041011	044411	030665	025011	125212	..!")"B.I.15*.*
35010	000776	126400	046661	030627	002401	000000	020423	024423	..-.M11.....!.)
35020	000763	060210	102400	041011	002421	060210	001400	063410	.s`...B....g
35030	002415	060277	063410	000777	060210	126400	046635	060177	..?g....-..M.
35040	002405	000200	033525	100200	033033	032651	000011	000000	..7U..6.5)....
35050	000000	177777	035132	000000	035126	035137	035141	000000	..CORPORATION..
35060	000030	071120	071150	000000	000000	000000	000000	000000	..rPrh.....

35700 000000 000000 000000 000000 ---- ---- ---- ----
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